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# SIUSLAW

# ENVIRONMENTAL ANALYSIS RECORD

## FOR PROPOSED

# OIL AND GAS LEASING

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

## EUGENE DISTRICT
## OREGON

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# SIUSLAW OIL AND GAS LEASING
# ENVIRONMENTAL ANALYSIS RECORD

= ANALYSIS AREA

MAP 1

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EAR

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# I. DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

## INTRODUCTION

The potential impact of proposed oil and gas leasing on National Resource lands in portions of the Eugene and Roseburg BLM Districts is analyzed in this Environmental Analysis Record (EAR). The area under consideration is located in Western Lane County and Northwestern Douglas County (See Map 1) and includes approximately 83,600 acres, of which approximately 45,500 acres are under private or state ownership.

Federally owned lands are as follows:

| | |
|---|---|
| Revested Oregon and California (O&C) Railroad Lands | - 36,941.42 Acres |
| Public Domain | - 1,153.00 Acres |

All Federal lands within the EAR area, including both surface and mineral estates, are administered by the BLM and are under oil and gas lease application as of the date of this record. The distribution of the lands in each of the nineteen separate applications is shown on Map 2. Legal descriptions for each application area are included in Appendix A.

The proposed action is the leasing of BLM adminstered lands, so the major emphasis of this analysis is concentrated upon the Federal lands within the EAR boundaries. However, impacts could be felt on intermingled private and state lands and on bordering land areas, so descriptions, impact analysis, and possible mitigating measures are presented after considering the entire area.

This environmental analysis was prepared by an interdisciplinary team of BLM resource specialists. Information on the land and other resources was obtained from inventories and data furnished by federal, state and local agencies and individuals having direct knowledge of the area.

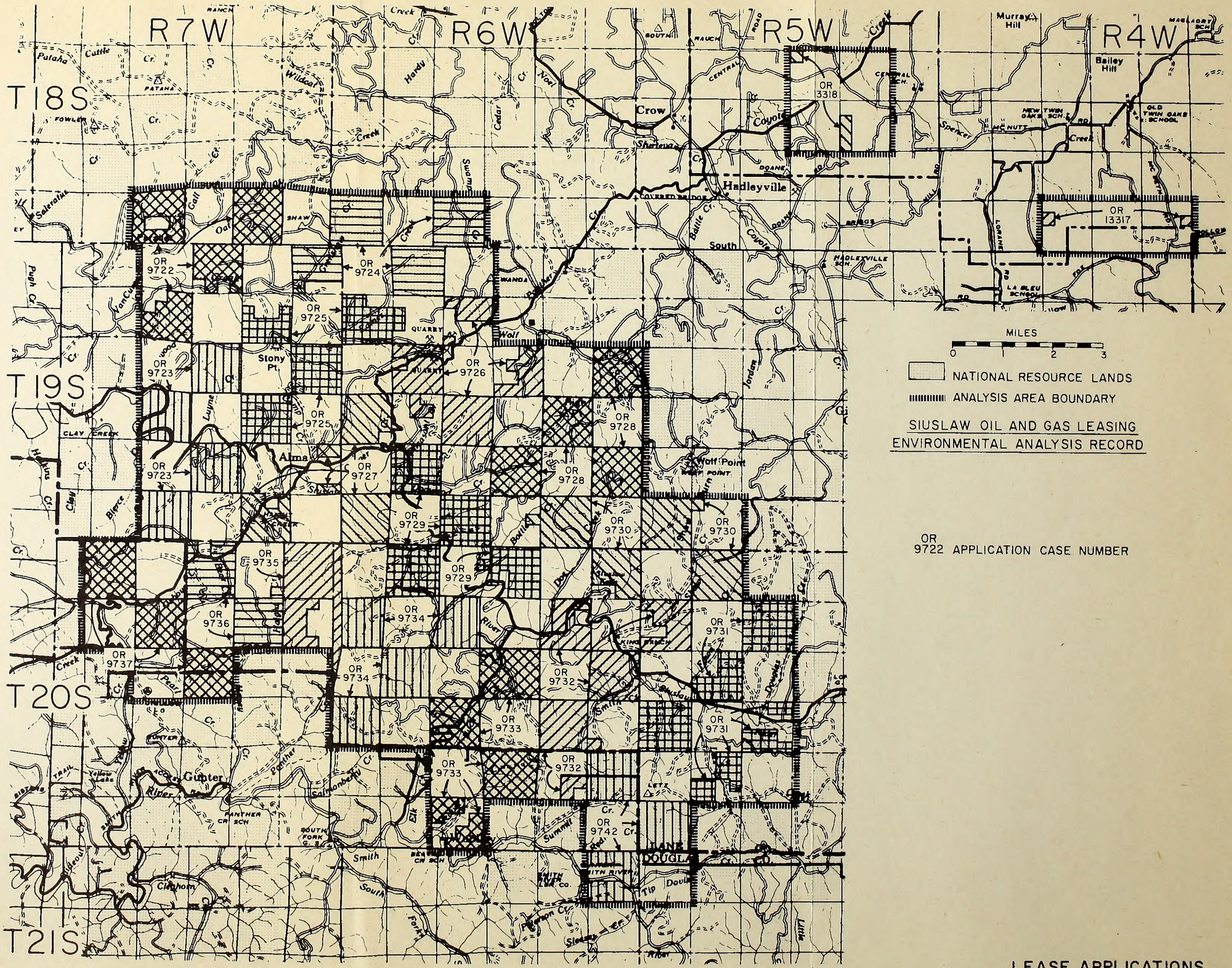
The nineteen applications considered in this EAR were among 212 applications on file as of February 9, 1976, for federal oil and gas leases in Oregon. The applications are located in seven BLM districts, and each district office will prepare an environmental analysis record before decisions are reached on the applications. A statewide overview of the development which might occur if the leases are issued is included in Appendix M.

## PROPOSED ACTION

The proposed action involves the leasing of Federally-owned oil and gas resources, with special stipulations, pursuant to the Act of February 25, 1920 (41 Stat. 437), as amended (30 U.S.C. 181-263).

### A. Purpose of Action

The purpose of issuing Federal oil and gas leases in Western Oregon is to permit exploration for and, if commercial reserves are discovered, development of oil and gas resources.




SIUSLAW OIL AND GAS LEASING
ENVIRONMENTAL ANALYSIS RECORD

OR
9722 APPLICATION CASE NUMBER

LEASE APPLICATIONS
MAP 2

B. Federal Oil and Gas Leasing Procedures.

Roles of Bureau of Land Management and U. S. Geological Survey: BLM administers Federal laws and regulations relating to mineral resources on land under its primary jurisdiction (National Resource Lands), Federal lands withdrawn for other agencies, acquired Federal lands, and Federal mineral reserves in private lands. BLM, in consultation with the U. S. Geological Survey (USGS) determines whether, and the conditions under which, Federal oil and gas leases will be issued. If the lands being considered for leasing are withdrawn for another Federal agency, that agency is involved in the process of determining whether the land will be leased. All Federal lands within the Siuslaw EAR boundaries are National Resource Lands.

After leases are issued on lands administered by BLM, the Geological Survey, in consultation with BLM, administers oil and gas operations on the leases. The Geological Survey is responsible for maintaining engineering, geologic, geophysical, economic, and other technical expertise needed to assure compliance with applicable laws, regulations, and Departmental objectives. BLM and Geological Survey responsibility for administration of oil and gas operations on Federal leases are described in Secretarial Order 2948 and the implementing working agreement. (Copies of the order and working agreement are included in Appendix B).

Administration of Geophysical Explorations: Geophysical explorations normally are conducted before an oil and gas lease is obtained. However, the procedures are described here to provide an overview of the full range of administrative activities relating to oil and gas operations on Federal lands.

If a person wants to conduct geophysical explorations on BLM - administered lands which he has not leased for oil and gas, he must file a notice of intent with the appropriate BLM district manager before he enters the land (43 CFR 3045). This regulation does not pertain to lands where the Federal government owns the mineral rights but not the surface rights. When he signs the notice of intent form, the geophysical operator agrees to conduct the exploration activities according to terms and conditions designed to minimize adverse impacts. See Appendix C for a copy of the form and the terms and conditions. The applicant must also file a bond before entering the land.

When a notice of intent is received, a BLM district staff specialist reviews the proposed operation and may meet with the applicant in an effort to minimize the environmental effects of the surveys.

Upon completion of operations, the exploration company must restore the area as nearly as practicable to its original condition.

Geophysical explorations conducted after an oil and gas lease has been issued are governed by post-lease procedures as described beginning on page I-4.

Pre-Lease Procedures

(1) Land Use Planning. Land use capabilities and potential resource conflicts are considered in a document called a Management Framework Plan (MFP). The MFP indicates how land uses in a planning area will be coordinated and identifies constraints for future actions taken in the area. Basic resource data are recorded in inventory documents called Unit Resource Analyses (URA's). The Siuslaw (Eugene District) and Drain (Roseburg District) URA's and MFP's contain information pertinent to this EAR.

(2) Environmental Analysis. Before a decision is made on whether oil and gas leases will be issued in a specific area, BLM prepares an Environmental Analysis Record (EAR). The EAR describes the setting in which the action is to occur, possible environmental impacts of the proposed action, and measures to reduce adverse impacts of the proposed action.

(3) Lease Stipulations. Information gathered in the land use planning and environmental analysis processes and other data are used by BLM to determine whether oil and gas leases will be issued for specific lands and, if so, the conditions or stipulations to which the prospective lessees will have to agree prior to the issuance of the leases. Most of the stipulations in oil and gas leases issued in recent years relate to the prevention or mitigation of unfavorable environmental impacts.

All oil and gas leases issued by BLM at the present time contain an open-ended set of stipulations. The stipulations are included on B.L.M. Form 3109-5; a copy is included in Appendix D . These stipulations insure that after the lease is issued, USGS and BLM have additional opportunities to specify measures the lessee must take to protect environmental values.

Oil and gas leases also contain site-specific stipulations. These stipulations are developed individually for each lease area.

(4) Classification Report. Before a lease is issued, a classification report is prepared by the Geological Survey to determine whether the lease will be issued on a competitive or noncompetitive basis. The Geological Survey determines whether all or any parts of the area applied for are within a Known Geologic Structure (KGS). An area is classified as being within a KGS if it is within the trap, either stratigraphic or structural, of a producing oil and gas field as best as can be determined from the geologic data available at the time. If the area is in a KGS, it is not available for leasing until it is offered at a competitive lease sale. If the area is not within a KGS it may be leased on a noncompetitive basis.

No known Geologic Structures have been identified in Oregon.

Lease Issuance. If a tract has not been previously leased, a lease is issued on a noncompetitive basis to the first applicant (1) if the land is legally available, (2) if USGS determines that is is not a KGS, and (3) if BLM determines through the land use planning and environmental analysis processes that oil and gas development is acceptable and appropriate.

When leases outside KGS's expire, terminate, are relinquished or cancelled, land use plans and environmental analyses are reviewed to determine whether the tracts should be reoffered for leasing and, if so, the kind of stipulations to be added to the new lease. The tracts are reoffered by being posted on a monthly list. All applications for the posted tracts received during the filing period are considered to have been filed simultaneously. A public drawing is held, and one application is drawn for each tract.

If there are no simultaneous applications for a tract it becomes available to the first application submitted subsequent to the drawing. Noncompetitive leases are currently issued for a primary term of 10 years.

Since Oregon has no KGS areas at this time, no competitive leasing is scheduled in the state.

Lessees must furnish bonds conditioned upon compliance with the lease stipulations. Bonds must be furnished before a competitive lease is issued and before a drilling permit is issued on a noncompetitive lease.

Post-Lease Procedures. During the term of the lease, the Geological Survey supervises operations of the lessee in that portion of the lease tract within the "area of operations." (See the implementing working agreement for Secretarial Order 2948 in Appendix B for a definition of the area of operations.) The Geological Survey asks BLM for recommendations on surface protection measures before

the Survey acts on requests from lessees for approval of plans for drilling or other surface-disturbing operations. BLM administers the oil and gas leasing regulations, the terms of the lease and geophysical exploration actvities in that portion of the lease tract outside an area of operations.

The "open-ended" lease stipulation (Form 3109-5) requires the lessee, prior to entry upon the land, to submit for approval to the Geological Survey a map and surface use plan explaining the nature of the anticipated activity and surface disturbance. The lessee also submits this information to BLM. If the lessee proposes to conduct any activities which would disturb the environment, he will be required to obtain approval from the Survey at least once during the life of the lease. If he finds oil or gas and wishes to drill additional wells to develop the field or construct facilities needed to reach full production, he will be required to return to the Survey for approval of plans for each new stage of development. The information the lessee must furnish in the surface use plan is listed in the Geological Survey's Notice to Lessees number 6 (NTL-6). A copy is included in Appendix E.

For all exploratory well proposals, the USGS prepares an Environmental Analysis with input from BLM. If BLM so requests, the Geological Survey will also hold a joint field inspection with the operator and BLM, and any other interested parties to analyze the environmental impacts of the proposed action. Stipulations are attached to the drilling permit to minimize adverse environmental impacts. The lessee may be asked to change the proposed well site if drilling in the original location would have severe adverse environmental impacts.

If oil and gas is discovered, lessees, are required to submit additional lease development plans and permit requests to the Geological Survey for approval. After USGS has reviewed the proposed plans and permit applications and consulted with and received input from BLM, the proposed plans are modified, if necessary, to insure that proper construction practices are followed. The lessee is required to prepare for contingencies such as fires, accidents, blowouts, spills, and leaks, and to notify various state and Federal agencies, such as the Environmental Protection Agency, in the event of an oil leak or spill.

The Geological Survey is responsible for the final approval of abandonment operations when oil and gas operations are terminated. The Survey will not approve the abandonment unless reclamation is carried out to the satisfaction of BLM. When abandonment or cessation of operations results in expiration, cancellation, or relinquishment of the lease, the Geological Survey and BLM inspect the leasehold area for compliance with the surface protection and reclamation stipulations in the lease and drilling permit. The lessee is required to reclaim the area insofar as practicable to its condition prior to the oil and gas operations.

C. Regulation of Oil and Gas Operations by the State of Oregon

Oregon is an associate member of the Interstate Oil Compact Commission and has adopted many of the policies and model rules suggested by this group of state regulatory agencies. State rules require bonding, blow-out prevention equipment, controlled disposal of brines, and the cementing and casing of wells. State law also sets well spacing limits and provides for the protection of correlative rights of landowners. In 1961 the Legislature passed a unitization law which defines the conditions for forming field-wide operating units, provides for settlements between working interests and allows compulsory unitization when 75% of the royalty ownership favors unit operations.

State regulatory authority is vested in the Department of Geology and Mineral Industries which issues drilling permits, approves casing programs, inspects blow-out prevention equipment, witnesses abandonment plugging, and collects well records. In the event of a discovery, the Department's rules require uniform development and regular reporting of storage and production. Stipulations added to the drilling permit at the request of the State Department of Environmental Quality require compliance with state air and water quality laws.

Before drilling permits are issued, the applications are reviewed by the Department of Environmental Quality, Water Resource Department, Fish and Wildlife Commission, and the Department of Land Conservation and Development.

D. Summary of Oil and Gas Leasing and Exploration in Western Oregon

Oil and gas drilling activity in Western Oregon has fluctuated widely over the years since the first wildcat well was drilled near Newberg in 1902. The drilling has produced numerous shows of oil and gas but no commercial discoveries. Most of the more than 100 wells drilled up to 1975 in Western Oregon were less than 2,000 feet deep. More than 20 wells drilled since 1940 were over 4,000 feet deep. The deepest was drilled in 1955 in the Siuslaw National Forest in Lane County; it was drilled to a depth of 12,880 feet.

Almost all oil and gas drilling in Western Oregon has taken place on private land.

Ten exploratory wells have been drilled on Federal lands in Oregon. The only well drilled on Federal land in Western Oregon was the deep hole in the Siuslaw National Forest.

Drilling activities accelerated on private land, but not on Federal land, in Western Oregon in 1975.

## E. Oil and Gas Operations

Petroleum operations progress through five phases: (1) preliminary investigations; (2) exploratory drilling; (3) development; (4) production and (5) abandonment. The five phases are illustrated in the following figure.

Several phases may occur simultaneously in an area. One company may drill an exploratory well on a lease while another company conducts preliminary investigations on adjacent areas. However, if only one company is interested in the area, normally only one phase of the operation will take place at a time.

Exploratory wells are drilled on a small percentage of the area covered by preliminary investigations.

Preliminary Investigations. Preliminary investigations often precede the issuance of a lease. They are described in this section to provide an overview of the entire range of oil and gas operations.

Preliminary investigations begin with an office review of geological and technical data available for the region. In many oil and gas producing regions, an office analysis may develop enough information to proceed with drilling without conducting additional preliminary investigations. However, the office analysis may indicate only a broad prospective area, and further preliminary investigations may be required.

Preliminary investigations are made from the air and on the ground.

(1) Airborne Investigations. Small aircraft and helicopters are used to conduct visual reconnaissance, photographic, and geophysical surveys.

(2) Surface Investigations. On-the-ground geological and geophysical surveys may involve either casual or intensive use of the land. Casual uses generally do not disturb the surface. Intensive uses include operations which require clearing of new access trails, movement of heavy equipment, or other actions which can result in substantial surface disturbance.

Geological surveys normally are a casual use. Rock outcrops and topography are examined to determine the structural attitude and age of surface formations, and geologic maps are prepared. In many areas, rock outcrops have been mapped and sufficient information obtained to enable the geologist to

recommend a drilling location without conducting additional surface exploration work. However, when surface structures are not present or do not provide conclusive indications of subsurface structures, geophysical investigations may be needed to outline structures where oil or gas may be trapped.

Geochemical and soil-gas surveys involve casual use of the land. In geochemical surveys, the chemical contents of water, soil or vegetative samples are analyzed for the presence of oil or gas. In soil-gas surveys, soil samples are analyzed to determime whether minute traces of gas have escaped to the surface from petroleum reservoirs.

In geophysical surveys, subsurface formations are evaluated by analyzing properties such as gravity, electrical conductivity, magnetic susceptibility and structural attitude. The seismic survey is one of the most commonly used geophysical methods. It is an intensive use method and involves the use of heavy truck-mounted equipment. Other geophysical methods, such as temperature, gravity, magnetic and radiation surveys, usually are confined to existing roads and trails.

In seismic surveys, a shock wave is sent into the subsurface and the time required for the wave to travel to and return from a subsurface horizon is recorded. A map of the subsurface can be drawn from an analysis of the differences in the time it takes the wave to be reflected back to the surface from the various rock formations.

Explosive, thumper or vibrator methods are used to produce the shock wave.

In the explosive method, shot holes are drilled to a depth of 50 to 200 feet. Four to twelve holes are drilled per mile of line. The holes are loaded with 5 to 50 pounds of explosives and detonated. The same hole may be reloaded and shot several times to find the depth and explosive charge returning the best reflection or refraction signal.

The thumper and vibrator methods pound or vibrate the earth to create a shock wave. Less than 50 square feet of surface area is required to operate the equipment at each test site. If there is brush or loose rock in the area, it may be removed to provide a more solid base for the test.

The sensors and energy source are typically located along straight seismic lines laid out on a 1- to 2- mile grid. Existing road systems are used where available. Lines may be cleared of vegetation and loose rocks to improve access for the trucks. Each mile of line cleared to a width of 8-1/4 feet utilizes one acre of land.

Exploratory Drilling. This phase does not begin until a lease has been acquired by the operator. In areas where preliminary investigations are favorable and information warrants further exploration, exploratory drilling may be conducted. More precise data on the geological structure are obtained by stratigraphic tests utilizing shallow holes. The presence of suspected oil and gas deposits may be confirmed by wildcat drilling of deep holes.

Both the stratigraphic tests and wildcat wells require a permit to drill issued by the appropriate Geological Survey District Engineer. The State of Oregon also regulates exploratory drilling and associated activities and facilities.

(1) Stratigraphic Tests. Stratigraphic test holes may be drilled 100 to 500 feet deep to locate geologic indicators. The holes can be drilled with truck-mounted equipment and disturb a relatively small area. Occasionally stratigraphic tests may be drilled thousands of feet deep using large rigs. Stratigraphic holes in areas of shallow high pressure gas zones are cased. The roads and trails constructed for access to such test sites are temporary and involve minimal construction. The drill site may occupy approximately 900 square feet and is sometimes placed in the center of a new or existing trail.

(2) Exploratory Wells. Exploratory wells require larger drilling rigs with support facilities, and may disturb a larger surface area than stratigraphic tests. Required facilities include roads, drill pads, mud pits and--in some rare cases--camps and airports.

Nationwide, one out of every 7 exploration wells drilled in 1974 was finished as a producer. However, only one in 59 resulted in the discovery of significant recoverable reserves (more than 1 million barrels of oil or 6 million cubic feet of gas). Of the 200 or so wells drilled in Oregon, none has been financially successful.

After a drilling site has been selected, a heavy-duty road is built to move the drilling rig and other equipment to the location. The roads are not designed for permanent access.

The well site occupies about an acre and is cleared of all vegetation and graded nearly flat. Depending on terrain conditions in the area, the well site or drill pad and roads may or may not be graveled. The drilling rig, mud pumps, and mud pit, generators, pipe rack, and tool house are located on the drill pad. Other facilities such as storage tanks for water and fuel may be located on or nearby the drill pad.

A water supply is required for mixing drilling mud, cleaning equipment, cooling engines, and other uses. A pipeline may be laid several miles to a pump installed at a stream or to a water well.

The drilling mud is maintained at a specific weight and viscosity to cool the bit, reduce the drag of the drill pipe on the sides of the well bore, seal off any porous formation, contain formation fluids to prevent a blowout or loss of drilling fluid, and bring the drill cuttings to the surface for disposal. Various additives are used in maintaining the drill mud at the approximate viscosity and weight. Some of the more rarely used additives are caustic, toxic, or acidic in nature. Others are simply weight additives and fluid loss additives. (Drilling mud materials are listed in Appendix F.)

A well completion requires installation of steel casing between the surface casing and the pay zone. The casing is selectively cemented to provide stability and to protect specific zones. The drilling rig and most of the support equipment are usually moved from the well site after the casing is cemented.

Storage tanks are required to hold oil produced from an exploratory well. A separator may be required to separate the oil and gas. If water is produced with the oil, a treater may be needed.

If gas is discovered, the operator is allowed to flare only enough gas for a short period of time to determine the well's capabilities. The well is then shut-in until a gas line is constructed.

The completion of an exploratory well as a commercial producer usually marks the beginning of the development phase.

Development

(1) Well Spacing Pattern. A well spacing pattern may be established before development drilling begins to determine the spacing unit assigned to each well.

If a well spacing pattern has not been previously established for the area, the operator proposes a spacing pattern to the State regulatory agency and to USGS for approval pursuant to the Oil and Gas Operating Regulations, 30 CFR 221. Information considered by USGS in establishment of a well spacing pattern includes data obtained from the discovery well on the porosity, permeability, pressure, lithology and depth of formations in the reservoir; data on well producing rates and type of production (predominantly oil or predominantly gas) and the effects of the proposed well spacing pattern on the economics of recovery.

Most spacing patterns established at the present time for Federal leases set minimums of 40 acres per well for oil production and units of 160, 320, or 640 acres per well for gas production.

(2) Drilling Procedures. Procedures used in drilling development wells are about the same as those used for an exploratory well, except that there usually is less subsurface sampling, testing and evaluation.

(3) Surface Use. Facilities required for development drilling many include access roads; well sites; flowlines; storage tank batteries; facilities to separate oil, gas, and water; and injection wells for salt water disposal. In remote locations, camps and air strips may be required.

Access roads usually are better planned, located and constructed than roads built during the drilling of exploratory wells.

When an oil field is developed on the current minimum spacing pattern of 40 acres per well, the wells are 1/4 of a mile from each other. If a section (1 square mile) is developed with 16 wells, at least 4 miles of access roads are built, and 4 to 6 miles of flowlines are installed between the wells and the tank batteries. Models of surface use requirements of oil production on 20-acre to 640-acre per well spacing patterns are illustrated in Appendix G.

Surface uses in a gas field will be significantly less than in an oil field because gas wells usually are drilled on 160-acre per well or larger spacing units. A 160-acre per well spacing pattern requires four wells per section and 2 miles of access roads and pipelines. Separation and storage facilities are not required for gas production unless the production is rich in liquids, or condensate. It may be sold without separation and the purchaser may separate the liquids at a central processing point far removed from the lease.

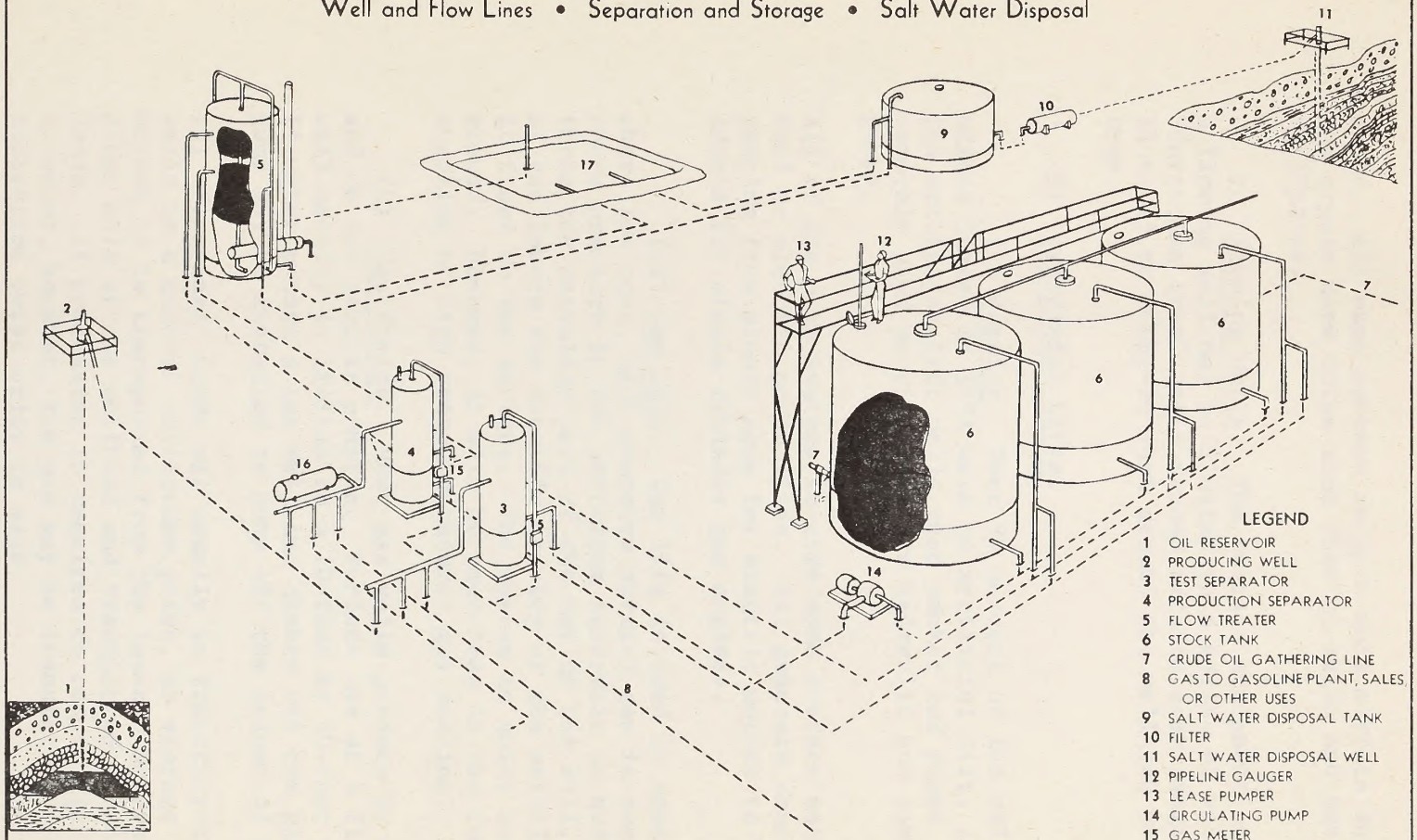
Production. Oil and gas field facilities are illustrated in the following diagram.

(1) Well Facilities

(a) Oil Fields. Pressures in some petroleum reservoirs are great enough to force oil to the surface. The result is a flowing well. However, most oil wells in the United States require the use of some means of artificial lift to bring the oil to the surface. Pumping and a technique known as "gas lift" are the two methods of artificial lift used at present. Flowing wells and wells with gas lift facilities require a minimum of equipment at the surface and produce little or no

# FLOWING OIL PRODUCTION

Well and Flow Lines • Separation and Storage • Salt Water Disposal




LEGEND

1 OIL RESERVOIR
2 PRODUCING WELL
3 TEST SEPARATOR
4 PRODUCTION SEPARATOR
5 FLOW TREATER
6 STOCK TANK
7 CRUDE OIL GATHERING LINE
8 GAS TO GASOLINE PLANT, SALES OR OTHER USES
9 SALT WATER DISPOSAL TANK
10 FILTER
11 SALT WATER DISPOSAL WELL
12 PIPELINE GAUGER
13 LEASE PUMPER
14 CIRCULATING PUMP
15 GAS METER
16 CHEMICAL INJECTION
17 EMERGENCY SALT WATER PIT

FACILITIES IN A FLOWING OIL FIELD

sound. All pump systems require more surface equipment and create more noise than flowing wells and gas lift facilities.

i. Flowing Wells. The surface equipment at the head of a flowing well may be limited to a series of valves, or "Christmas tree" and a fenced service area ranging from 15-by-15 to 50-by-50 feet around the wellhead and Christmas tree.

ii. Artificial Lifts.

(i) Pumping. Over 90 percent of the oil wells in the United States in 1971 were on artificial lift, and most of the artificial lift wells used sucker rod pumps. Other pumps commonly used on oil wells are hydraulic and centrifugal pumps.

All of the pump systems require some surface equipment and fuel or electric power lines. All generate some noise, ranging from almost none for electric motors to high noise levels for single cylinder gas engines.

(ii) Gas Lift. Gas lift is used in some oil fields where low cost, high pressure natural gas is available and where pressure in the petroleum reservoir is sufficient to force the petroleum part of the way up the well. The addition of gas lowers the specific gravity of the petroleum so that it flows to the surface. The system is quiet and uses little ground. However, it will be used less in the future as supplies of high pressure natural gas decline.

(b) Gas Fields. Most gas wells produce by normal flow and do not require pumping. Surface use at a flowing gas well usually is limited to a 20-foot by 20-foot fenced area. If water enters a gas well and chokes off the gas flow, a pump may be installed to pump off the column of water.

(2) Flowlines Crude oil usually is transferred from the wells to a central collection point, or storage tank battery, before it is transported from the lease. Natural gas is often sold at the wellhead and transported directly off the lease. If processing is required to remove liquid hydrocarbons or water, however, the gas may be transferred to a central collection point prior to sale.

Oil and gas are transferred from the wells to central collection points in flowlines. The flowlines usually are 3- or 4-inch diameter steel pipes. They may be buried, installed on

the surface, or elevated. Natural and man-made corrosive liquids, groundwater and salt concentrations and electric currents can corrode buried steel pipe. Several protective measures have been developed. They include coating the steel pipes with paint, plastic, cement, felt wrapping and bitumen; feeding controlled electric currents to the metal flowlines; burying masses of metal and attaching them metallically to the metal flowlines and substituting nonmetal pipe for steel.

(3) Separating, Treating and Storage Facilities. If the fluids produced at the well contain gas and water, the oil, gas and water are separated before the oil is stored in the tank battery. The batteries usually contain at least two tanks and usually are located on or near the lease.

Small leases may contain only one tank battery; large leases may contain several, with each battery containing separating, treating and storage facilities.

(4) Disposal of Produced Water. After water is separated from oil at the tank battery, it is disposed of under USGS supervison (see NTL-2B included in Appendix E). Although most produced waters are brackish to highly saline, the quality of some produced waters is adequate for beneficial surface use. Ranchers and farmers in some cases have filed prior rights claims on produced water so they can use it for agricultural purposes.

Unusable produced water is disposed of in evaporation pits or by subsurface injection. Evaporation pits are used mainly in arid regions where evaporation rates are high. In areas such as Western Oregon where rainfall exceeds the evaporation rate, disposal by evaporation is not feasible.

USGS may require that evaporation pits be lined with an impervious material and be inspected periodically to insure that the lining is maintained. Concrete, asphalt, plastic, bentonite and epoxy resins are used for pit linings.

Because salt water seldom issues from heater-treaters or gun barrels completely free from oil, oil skimmer pits are installed between the separating facilities and the evaporation pits, when surface disposal is used.

When salt water is disposed of underground, it usually is introduced into subsurface horizon containing water of equal or poorer quality. It may be injected into the producing zone from which it came or into other producing zones. In some cases, this stimulates oil production.

In some fields, dry holes or depleted producing wells are equipped for salt water disposal; but occasionally new wells are drilled for disposal purposes. Cement is squeezed between the casing and sides of the well to prevent the salt water from migrating up or down from the injection zone and into other formations. The salt water is injected down the well through tubing.

Depending upon the porosity, permeability and pressure of the disposal zone, the salt water may be injected without pressure.

If pressure is required, an injection pump is used to force the salt water into the disposal zone.

(5) Methods of Increasing Petroleum Recovery

(a) Oil. Oil cannot be produced unless forces within the petroleum reservoir are great enough to drive the oil to the well bore. Primary production occurs when energy in the reservoir is sufficient to drive the oil to the well. When natural energy sources are inadequate, secondary production methods involving gas or liquid injection may be used to supplement the natural forces.

In water flooding, the most commonly employed form of secondary recovery, water is injected into the reservoir to drive additional oil to the producing wells. On the average, a successful waterflood will increase recovery by roughly 100 percent.

Other secondary techniques for improving oil recovery have been tested, including miscible flooding (injecting chemical compounds with water) fire flooding (starting a controlled fire in the reservoir) and steam flooding (injecting steam into the reservoir). Some of the techniques have been used for tertiary recovery after a water flood.

Natural gas also is injected into some oil reservoirs during primary recovery as a pressure maintenance program.

(b) Gas. In some gas condensate reservoirs, some of the components of the gas condense into liquid form near the well bores when production reduces pressures in the reservoir. The resulting reduction in permeability may cause a significant loss in recovery. To prevent this, gas is injected to maintain pressure above the lower condensation pressure.

(6) Land Required for Oil and Gas Producing Facilities. Possible land requirements for oil field facilities on leases with well spacing patterns ranging from 20 to 640 acres per

well are delineated in Appendix G. The land uses for all facilities in a developed field may range from 22.4 acres per square mile with a 20-acre per well spacing pattern, to 2.4 acres per square mile with a 640-acre per well spacing pattern.

Less land is usually used in gas fields than in oil fields because gas production does not require storage on the lease.

(7) Employment. The number of people required to operate an oil and gas field varies with the characteristics of the production and the number of leaseholds in the field. If the wells flow without pumping, one employee in a large, modern field can control production of about 25 wells. When wells are pumped, one employee in large modern field can control production on 10 to 20 wells. If oil storage tanks are manually gauged and sampled, one employee can service approximately 25 tanks. If automatic gauging and sampling devices have been installed, one person can service the equivalent of 100-150 tanks. In a large, modern field, one five-man maintenance crew can service up to 50 wells.

Abandonment

(1) Exploratory and Development Wells. Dry exploratory and development wells normally are plugged before the drilling rig is removed. This allows the operator to use the drilling rig to plug the hole and avoid bringing in other plugging equipment. The operator must obtain permission from the USGS district engineer to plug the well.

Well plugging requirements vary with the characteristics of the rock formations, subsurface water and the well. Generally, however, the hole is filled with heavy drilling mud to the bottom of the cemented casing. A cement plug is installed in the bottom of the casing, the casing is filled with heavy mud and a cement cap is installed on top of the well. In uncultivated areas, a pipe may be installed as a monument giving location and name of the well. In croplands, the casing is cut off and capped below plow dpeth, and no monument is installed. Plugging requirements provide for protection of aquifers, known oil and gas producing formations and zones of good porosity in deep wells by placement of additional cement plugs.

After plugging is finished, the drilling rig is removed and the surface, including the reserve mud pit, is restored to its original condition, insofar as possible and according to requirements of the surface management agency. The operator's report of abandonment is approved by USGS after the surface restoration has been approved by the surface management agency.

(2) Production and Injection Wells, and Related Facilities. Before a lessee abandons a former producing well, he must demonstrate its unsuitability for further profitable production to the USGS district engineer. A copy of the operator's notice of intention to plug and abandon is transmitted to the surface management agency to obtain the agency's recommendations on surface restoration.

In some cases, wells are plugged as soon as they are depleted. In other cases, depleted wells are not plugged immediately, but are allowed to stand idle for possible later use in a secondary recovery program.

Truck-mounted equipment is used to plug former producing wells. In addition to the measures required for a dry hole, plugging of a depleted producing well includes the installation of a cement plug in the perforated section in the former producing zone and - if casing is salvaged - a cement plug is put across the casing stub. In cultivated areas, the cement pumpjack foundations are removed or buried below plow depth. In areas where removal or burial would cause more surface damage than the foundations, they are left at the site.

When an entire lease is abandoned, the separators, heater-treaters, tanks and other processing and handling equipment are removed and the surface restored. Flowlines and injection lines installed on the surface are removed, but buried lines usually are left in place. The operator's bond with the Federal Government is not terminated until the surface management agency has approved surface restorations, USGS has approved subsequent reports of abandonment and royalties due the Federal Government have been received.

F. Summary of Standard Mitigating Measures

The preceding sections on Federal leasing procedures and State regulation of oil and gas operations refer to regulations and standard notice forms and stipulations which would apply to all geophysical explorations for oil and gas and/or activities of oil and gas lessees on national resource lands in Oregon. The notice forms, stipulations, and regulations are summarized below.

"Notice of Intent to Conduct Oil and Gas Exploration Operations," BLM Form 3040-1. Geophysical exploration companies are required to complete this form before conducting geophysical operations on national resource lands. The form contains terms and conditions under which the operations must be conducted. More detailed conditions may be established to meet the unique requirements of the area where operations will be conducted. (Appendix C )

Section 2, paragraph (q) of the Federal oil and gas lease form (BLM Form 3120-7), "Protection of Surface, Natural Resources, and Improvements." (Appendix H).

BLM Form 3109-5, "Surface Disturbance Stipulations." These are the "open-ended" stipulations. They are made a part of each oil and gas lease issued by BLM at the present time. These stipulations insure that, after the lease is issued but before drilling operations are started, USGS and BLM have additional opportunities to establish conditions which the lessee will have to meet. (Appendix D).

"Cultural Resource Stipulations to Oil and Gas Leases." This is the cultural resource protection stipulation included in all oil and gas leases issued in Oregon at the present time. (Appendix I).

30 CFR 221. These are the Geological Survey's Oil and Gas Operating Regulations. Among other things, they include requirements relating to well casing, well abandonment, and other mitigative measures.

Geological Survey Notices to Lessees and Operators of Federal Oil and Gas Leases. Notices to lessees and operators ("NTL's") transmit the Geological Survey's operating requirements to lessees.

(1) NTL-2B prescribes requirements for handling, storing, and disposal of water produced from oil and gas wells. (Appendix E).

(2) NTL-3 requires lessees to report discharges of pollutants and prescribes the contents of the reports.

(3) NTL-4 requires lessees to pay royalties on oil and gas lost because of blowouts, fires, or other reasons.

(4) NTL-6 formalizes the requirement by the Geological Survey that an oil and gas operator furnish a surface use and operating plan to the Survey and BLM and receive approval before entering the lease to conduct drilling operations. USGS and BLM use information in the surface use plan and other data collected by the agencies to develop environmental protection measures. The measures are included as conditions of the drilling permit issued by USGS. (Appendix E).

40 CFR 112. These U.S. Environmental Protection Agency regulations identify procedures, methods, and equipment to be used to prevent the discharge of oil from non-transportation-related onshore and offshore facilities into navigable waters. The regulations apply to owners and operators of facilities engaged in oil and gas drilling, producing, gathering, storing, and other non-transportation-related activities. Oil and gas operators are required in the regulations to prepare Spill Prevention Control and Countermeasure Plans.

40 CFR 1510. These Environmental Protection Agency regulations contain the National Oil and Hazardous Substances Pollution Contingency Plan. As stated in the regulations, the plan

> provides for a pattern of coordinated and integrated response by Departments and Agencies of the Federal Government to protect the environment from the damaging effects of pollution discharges. It promotes the coordination and direction of Federal and State response systems and encourages the development of local government and private capabilities to handle such discharges.

In addition to these Federal regulations, stipulations, and administrative procedures relating to Federal lands, an oil and gas operation in Oregon would be subject to State laws and regulations regarding pollution control. The following State regulations and stipulations are applicable.

(1) Chapter 632 of the Oregon Administrative Rules. These are the Department of Geology and Mineral Industries regulations on oil and gas operations.

(2) "Special Conditions to Apply to All Deep Well Exploratory Drilling in Oregon." The Departments of Environmental Quality and Geology and Mineral Industries agreed in September 1975 that these stipulations would be part of future drilling permits issued by Geology and Mineral Industries. (Appendix J ).

## ALTERNATIVE TO THE PROPOSED ACTION

Denial of oil and gas leasing on national resource lands within the analysis area might be considered an alternative to the proposed action. However, considering the nature of the laws and regulations pursuant to which oil and gas lease applications are made, denial requires cause, and denial for cause assumes an objective evaluation. Such is one purpose of this environmental analysis -- to ponder the significance of residual environmental impacts (those that remain after all reasonable mitigating measures are applied) to determine if there is justification for a recommendation of denial. Denial, therefore, is a possible environmental consideration in the process of deciding whether to lease or not to lease.

For the following reasons an analysis of the "no leasing" alternative would have little practical significance:

1. As an alternative action, since no exploration or development would take place, lease denial would obviously have no adverse, on-site, environmental impact relative to national resource lands.

2. Off-site impacts, primarily socio-economic in nature, could be affected by the no leasing alternative only if an economic quantity of oil and/or gas is assumed. Using that assumption, the impacts of no leasing involve considerations far beyond the reasonable scope of a regional or local analysis, e.g. national energy supply policies.

3. "No leasing" of national resource lands would not necessarily preclude resource development -- because of the checkerboard public/private pattern of land ownership, oil and gas development could proceed on private lands.

The spin-off effect on private lands resulting from no leasing on intermingled public lands must also be recognized. Though conjectural as to degree, the effect could be over development of the private lands with the possible multiplication of on-site environmental impacts.

## II. DESCRIPTION OF THE EXISTING ENVIRONMENT

### AIR

Within the analysis area air quality is considered relatively good on an annual basis. The very few industries, limited to small forest products mills, and light population density have little negative impact on the air quality. During summer months, with the northerly shift of prevailing winds, air pollutants from the Eugene-Springfield metropolitan area tend to drift into the analysis area. This drift is evidenced by an increased visual haziness, which, on occasion, is greatly compounded by agricultural burning to the north. It appears reasonable to assume that summer air quality will continue to deteriorate as population and industry grow within the Eugene-Springfield area.

Conversely, the analysis area's potential influence upon the regional airshed must be recognized. Management activities, particularly during the fall and winter months when prevailing winds are southerly, can add to the deteriorating trend in air quality within the Eugene-Springfield area. This trend is a primary concern throughout the entire Willamette Valley and might best be expressed by the following excerpt from a Lane County, Technical Report:

> "The Willamette Valley may generally be described as a bowl, bounded by mountain ranges on the west, east and south. Temperature inversions act as a lid over the bowl. The mountains keep the air from escaping the valley sides and the inversion stops the air from escaping vertically.
>
> It is the topography of the valley, the severly restricted crosswinds and the frequency of temperature inversions that lead scientists to feel if projected growth and urbanization are reached the valley airshed could potentially be the most polluted in the United States." (1)

(1) Preliminary Comprehensive Land Use Plan for the Willamette-Long Tom Subarea, Technical Report, Lane County, Oregon, March 1975, p. 46.

## LAND

### A. Topography

With the exception of the small portions lying in T. 18S., R. 4 and 5W., the entire analysis area is located within the Oregon Coast Range physiographic province. The area is rugged and mountainous and is characterized by a mature stage of erosion. The slopes are steep and dissected with narrow ridges and side ridges. The valley bottoms are likewise narrow and form a complex drainage pattern with steep drainage gradients. Slopes throughout the area are steep to very steep. Slope classes for the entire BLM Siuslaw Planning Unit are presented in Table 1 . The average slope for the unit is 44% (24°). The analysis area is contained within and is typical of the Siuslaw Planning Unit. Map 3 shows the topography of a representative portion of the EAR area.

The seven sections constituting the EAR area in T. 18S., R. 4 and 5 W. lie in the foothill region along the border between the Coast Range and Willamette Valley physiographic provinces. Coyote Creek crosses this area and, in contrast to the remainder of the EAR, occupies a relatively broad (approximately one-half mile) and level valley.

The greatest elevation within the analysis area is High Point (1935 feet) which is located in Section 33, T. 19S., R. 6W. The lowest elevation is 390 feet along the Coyote Creek in Section 14, T. 18S., R. 5W. Maximum relief within the EAR area is thus 1545 feet.

### B. Geology

The analysis area lies entirely within the former western Tertiary marine basin of Oregon. The basin consists of a thick accumulation (10,000 - 25,000 feet) of marine sedimentary and volcanic rocks which have been uplifted and deformed since they were deposited some 25 to 65 million years ago. These strata underlie the Coast Range, the Willamette Valley and an undetermined portion of the Western Cascades. The thickness of the sedimentary pile, its structure, and the marine nature of the rocks make the basin an attractive area for oil and gas exploration even though no production has occurred in Oregon to date.

(1) Stratigraphy - The rocks exposed within the unit range from Middle Eocene (approximately 50 million years old) to Recent.

Tyee Formation. The Tyee formation is the oldest and by far the most widespread formation outcropping in the analysis area (see Map 4 ). The Tyee dominates the geology westward from Lorane and Coyote Creek. It consists of a thick sequence of rhythmically bedded sandstone and siltstone. Each bed grades gradually upward from a coarse basal sandstone to fine-grained siltstone at the top. The beds range in thickness from 6 inches to 12 feet, but are generally from 3

Table 1

Slope Classes, BLM Forest Lands

Siuslaw Planning Unit

| Slope Class | Degree Equivalent | Acres | Area % |
|---|---|---|---|
| 0-5% | 0 -3° | 10,300 | 6.6 |
| 6-15% | 3½-8½° | 19,500 | 12.5 |
| 16-25% | 9 -14° | 18,400 | 11.8 |
| 26-35% | 14½-19° | 20,500 | 13.2 |
| 36-45% | 19½-24° | 13,400 | 8.6 |
| 46-55% | 24½-29° | 14,300 | 9.2 |
| 56-65% | 29 -33° | 13,200 | 8.5 |
| 66-75% | 33½-37° | 16,400 | 10.5 |
| 76-84% | 37 -40° | 19,500 | 12.5 |
| 85+ % | 40°+ | 10,300 | 6.6 |
| | Total | 155,800 | 100.0 |

to 8 feet thick. The sandstone contains abundant mica flakes, is firmly compacted, and gray to bluish-gray in color, but weathers to yellowish-brown. The siltstone is dark and firm. Due to the calcareous nature of the cementing agent which holds the sand grains together, the Tyee breaks down rapidly when exposed to weathering. The base of the formation is not exposed, but approximately 5,000 feet of strata are present in the area. The age of the formation has been established as Middle Eocene based upon fossil evidence.

Spencer Formation. The Tyee is overlain by the upper Eocene Spencer Formation which is exposed in a belt trending slightly west of north extending along the boundary between R. 4W. and R. 5W. Within the analysis area it underlies only those sections in T. 18S., R. 5W. The Spencer consists of a sequence of arkosic, micaceous and tuffaceous sandstones, with a relatively thin but persistent basal silty shale and mudstone unit named the Lorane shale member. The lower part of the formation above the Lorane shale is a dark greenish-gray basaltic and arkosic sandstone very similar to the sandy portions of the Tyee Formation and believed to have been derived from the weathering of the Tyee. The Spencer Formation is approximately 2700-3400 feet thick, of this 600 feet is attributed to the Lorane shale member. The Spencer strata are generally soft and weather rapidly, typically forming deep soils. Outcrops of the Spencer Formation are relatively rare.

Fisher Formation. The Spencer Formation is overlain by approximately 7,000 feet of volcanic tuffs and conglomerates which comprise the Fisher Formation. This unit occurs eastward from the Lorane-Coyote Creek area. Within the EAR boundaries it outcrops only in Sections 33-35, T. 18S., R. 4W. The entire formation is non-marine. The basal beds are coarse conglomerates which may be up to 50 feet thick and which in turn are overlain by coarse tuffs and agglomerates of predominantly andesitic composition. Occasional beds of fine-grained purple-to-buff colored rhyolitic and dacitic ash occur interspersed among the tuffs. In places the Fisher Formation forms bold outcrops, while in areas where the ash and finer tuffs have weathered to clay, outcrops are rare and landslides are common. Based upon fossil flora evidence, the Fisher is believed to be late Eocene to Oligocene in age.

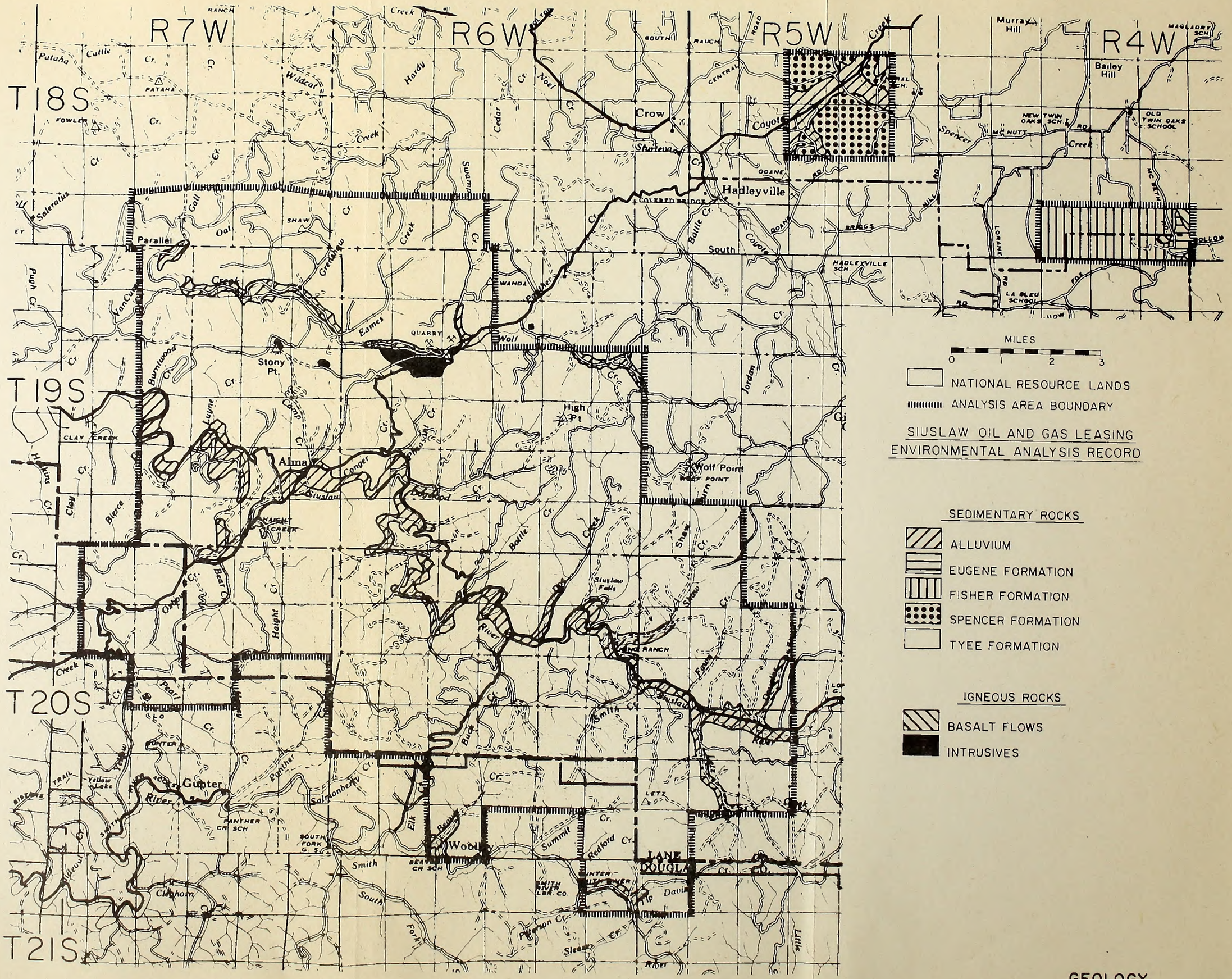
Eugene Formation. The Fisher Formation is superseded by a sequence of fossiliferous marine tuffaceous sandstones and siltstones which is known as the Eugene Formation. The sandstone, which is highly arkosic and micaeous, is dark olive to bluish gray on fresh exposures, but weathers to yellowish-brown. In places the Eugene sediments interfinger with coarser tuffs which resemble portions of the Fisher Formation. Approximately 8,000 feet of Eugene strata are exposed in the hills along the southern margin of the Willamette Valley. Abundant marine fossils indicate that the Eugene Formation is mid-Oligocene in age. Within the

R 6 W

CONTOUR INTERVAL = 50 ft.

**TOPOGRAPHIC MAP** – TYPICAL PORTION OF ANALYSIS AREA

MAP 3




GEOLOGY
MAP 4

analysis area, Eugene Formation strata have been found only in section 35 of T. 18S., R. 4W.

Intrusive Igneous Rocks. Dikes and sills of igneous rock have been intruded into the Tyee, Spencer, and Fisher Formations at many locations within the Coast Range. These rocks range in composition from gabbro (the coarse-grained equivalent of basalt) to diorite. Columnar jointing is well-developed in some of the larger intrusives. The only intrusive of any size that has yet been identified within the boundaries of this EAR is a sill which outcrops along Wolf Creek in Sections 8, 9, 16 and 17 of T. 19S., R. 6W. International Paper Company has developed a quarry in this intrusive body on private land in section 8. This quarry is the only source of crushed rock of any consequence within the analysis area.

Basalt Flows. Numerous flows of basaltic lava overlying Fisher and Eugene strata of Oligocene age are found in the hills to the north and west of Cottage Grove. The rock is predominantly an olivine basalt which commonly shows columnar jointing. These basalt flows are found within the analysis area only in section 35, T. 18S., R. 4W.

Alluvial Deposits. Deposits of unconsolidated silt, sand and gravel are found in the valleys of some of the larger streams, including Coyote Creek, Wolf Creek and the Siuslaw River. These deposits form a large portion of the level sites available within the analysis area.

(2) Structure - The gross structure of the central Coast Range is that of a broad arch elongated in a north-south direction that has been breached by erosion, exposing the oldest rocks, the Tyee Formation, along the axis of the range. Younger strata which overlie the Tyee outcrop along the flanks of the range. In the analysis area, the Spencer and Fisher Formations outcrop along the eastern edge of the Coast Range and dip eastward beneath the alluvium of the Willamette Valley at an angle of $10^{\circ}$ - $15^{\circ}$.

A few gentle folds in the Tyee beds have been identified. The fold axes trend NE-SW. Dips on the bedding planes seldom exceed $15^{\circ}$.

Small faults are probably numerous in the area, but weathering and vegetative cover have prevented their recognitiion.

(3) Economic Geology

Minerals. Aside from crushed quarry rock there has been little or no mineral production of significance from lands within the boundaries of this analysis. There are no known active mining claims on federal lands within the area.

A few scattered deposits of sub-bituminous coal have been reported, occurring as thin (1-2 inches) interbeds in the Tyee Formation. None of the occurrences reported to date are of economic interest.

The only material commodity of value known to have been produced within the EAR boundaries is quarry rock. All known quarrying operations have been limited to the igneous intrusive in sections 8, 9, 16 and 17 of T. 19S., R. 6W.

The USGS has classified the EAR area as prospectively valuable for oil and gas. Their records indicate no known or prospective values for other leasable minerals.

Oil and Gas Potential. Western Oregon geology contains all the elements required for the formation, accumulation, and entrapment of oil and gas. These elements are: (1) considerable thickness of sedimentary rock deposited in saline water; (2) strata with high organic content associated with reservoir rock; (3) reservoir beds of porous sands; (4) fold and fault structures or stratigraphic closures; and (5) impervious or capping strata overlying reservior beds.

Western Oregon is similar to oilproducing areas of southern California in that both have: (1) thick sequences of teritary marine strata which accumulated in formerly-existing deep structural basins; (2) wide belts of intertonguing nearshore and offshore marine and continental sediments; (3) locally thick sand units that formed along the shorelines of ancient seas; and (4) linear structural belts containing folds and faults that could have formed traps for the retention of petroleum.

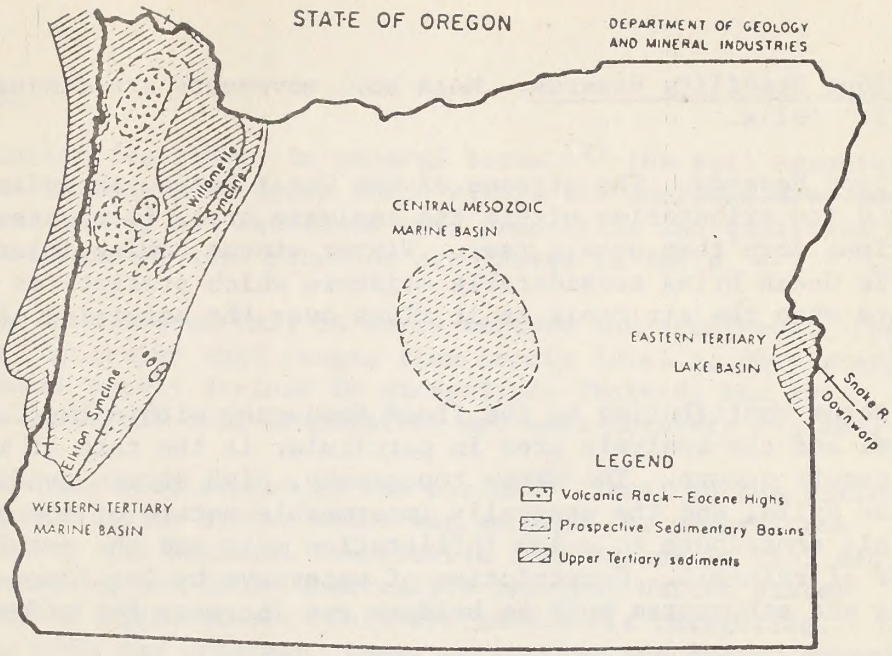
Major differences between the two areas are: (1) the lower Tertiary sedimentary sequence of Oregon contains a much greater amount of volcanic material; and (2) many oil seeps, tar pits, bituminous sandstone deposits and other significant surface indications of the presence of oil are found in Southern California but very few are found in Oregon. At the present time, the only recorded surface indications of oil in the Tertiary marine area of western Oregon consists of (1) organically rich shales near Newport, Lincoln County, which give off a petroliferous odor when freshly broken, and (2) the free oil reported in vesicles and cracks in Eocene basalt near Florence, Lane County.

Gas shows in Oregon are much more numerous and frequently occur with water. Gas shows have occurred in Polk, Columbia, Coos, Douglas, Lincoln, Linn, Multnomah, Tillamook and Washington counties. Though no commercially viable gas deposits have been found, several farmers are reported to have bubbled off the gas in their water wells and used it for space heating.

No oil or gas wells have been drilled in the past within the analysis area.

The location of oil and gas shows in wells and prospective sedimentary basins in Oregon are shown in the following maps.

(4) Geologic Hazards Geologic hazards present in Western Oregon include mass movement of unstable slopes, flooding, seismicity and volcanism.



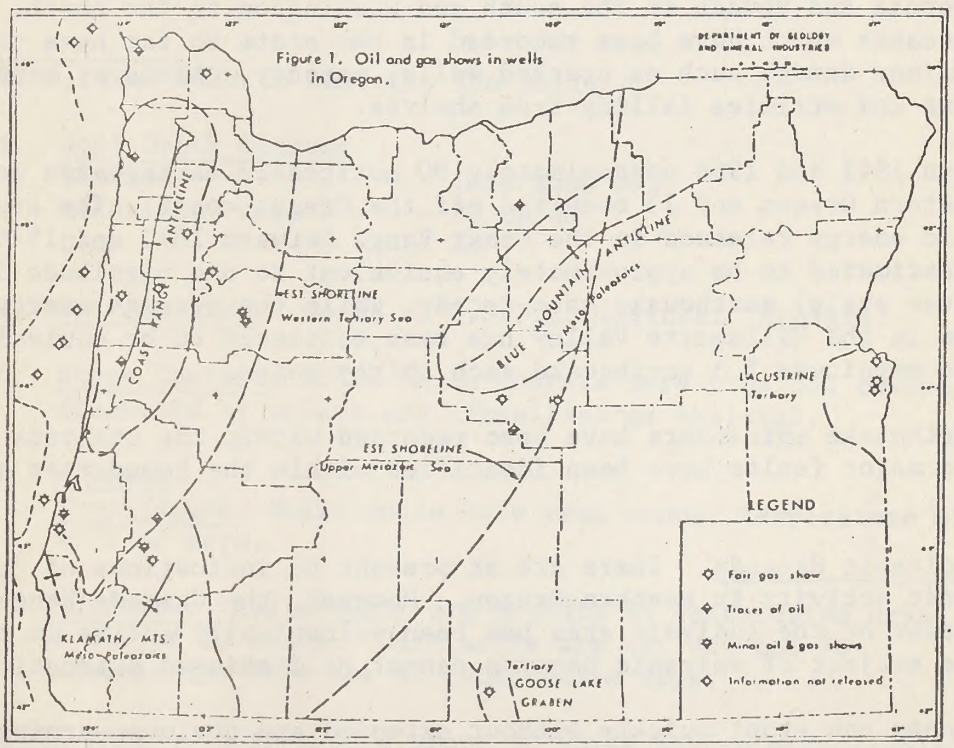




Figure 1. Oil and gas shows in wells in Oregon.

Slope Stability Hazards. Mass soil movements are discussed below in part C. Soils.

Flood Hazards. The streams of the Coast Range, including the Siuslaw and its tributaries within the analysis area, flood frequently and sometimes more than once a year. Winter storms coming inland from the Pacific Ocean bring considerable moisture which preciptates in heavy amounts when the air cools as it rises over the mountains of the Coast Range.

One factor contributing to the flood frequency within the Coast Range in general and the analysis area in particular is the rate at which rainfall runoff occurs. The steep topography, high stream gradients, generally shallow soils, and the generally impermeable nature of the sedimentary bedrock all contribute to a low infiltration rate and the resulting rapid runoff of rainfall. Constriction of waterways by log jams, landfills, piling and structures such as bridges can increase the effects of flooding.

Seismic Hazards. Although situated within the circum-Pacific earthquake belt, Oregon has experienced a relatively low level of seismic activity. Fewer earthquake shocks have been recorded in Oregon than in California and Nevada to the south and Washington to the north. Those earthquakes which have been recorded in the state so far have caused only minor damage such as cracked walls, masonry, chimneys, broken lights, windows and articles falling from shelves.

Between 1841 and 1958 approximately 90 noticeable earthquakes occurred in Western Oregon and 73 occurred off the Oregon coast. The average seismic energy released in the Coast Range between 1870 and 1970 has been estimated to be approximately equivalent to one magnitude 5.0 (Richter scale) earthquake each decade, while the average energy released in the Willamette Valley has been estimated to be equivalent to one magnitude 5.3 earthquake each thirty years.

No earthquake epicenters have been recorded within the analysis area and no major faults have been identified within the boundaries of this EAR.

Volcanic Hazards. There are at present no indications of future volcanic activity in Western Oregon. However, the Cascade Range which lies east of the analysis area has been volcanically active in the past so the subject of volcanic hazards cannot be dismissed automatically.

Volcanoes can erupt quickly without extended and obvious warning. Should an eruption occur, it is highly unlikely that it would be located elsewhere than along the volcanic centers of the High Cascades. The only effects that would possibly be felt within the analysis area would be earthquakes associated with an eruption and deposition of volcanic ash.

C. Soils

The following describes, in general terms,(1) the soil associations and miscellaneous land types found within the analysis area and delineated on Map 5. Pertinent soil properties and qualities and interpretations of soil behavior are listed in Table 2.

The soils in the area vary in depth texture and stoniness. They occur on topography that ranges from nearly level to very steep; are somewhat poorly drained to excessively drained; and are found in different soil temperature and soil moisture regimes.

The soils have been mapped at the series(2) level in the National Soil Classification System which was adopted for general use nationwide by the National Cooperative Soil Survey in 1965 and administered by the Soil Conservation Service, United States Department of Agriculture. This system has six categories. Beginning with the broadest, these categories are order, suborder, great group, subgroup, family and series.

---

(1) Some terms used to describe the soils:

a. Soil Depth Classes.
Shallow - - - - - - - - - less than 20"
Moderately deep - - - - 20 to 40"
Deep - - - - - - - - - 40"+

b. Soil Texture. Refer to U.S.D.A. Textural Triangle.

c. Stone Content. Soils which contain more than 35% coarse fragments by volume are classified as skeletal.

d. Climate.
Temperature. Mesic soils have mean annual temperature of 47°F or more.

Moisture. Xeric soils are dry for 45 consecutive days, 6 out of 10 years. Udic soils are not dry for 90 cummulative days nor 45 consecutive days.

(2) Soil Series consist of a group of soils having essentially uniform characteristics and genetic horizons which are similar in differentiating characteristics and in arrangement in the profile. Among these characteristics are color, structure, reaction, consistence, and mineralogical and chemical composition.

In the following discussion the major soils are described at the series level but only in brief and general terms, because draft soil inventory reports covering the area, but in different parts, are available at the Eugene and Roseburg District Offices which describe in detail each series mapped. Each series described has been officially established by the Soil Conservation Service and is identified by name.

Mixed Alluvial Land

This mapping unit, a miscellaneous land type, encompasses all the flood plains and alluvial bottom lands which comprise about five percent of the mapping area. These areas are dominanted by deep, well drained soils which occupy nearly level to gently undulating surfaces and deep, moderately well drained to poorly drained soils occurring on nearly level and depressional areas on floodplains and low terraces. Surface textures are predominantly a silty clay or silty clay loam.

The potential limiting factors to use and management on some soils in these locations are excessive wetness (high seasonal water table), flooding, very slow permeability and clayey textures.

Preacher-Digger-Apt Association, 35 to 90 percent slopes

This soil association comprises about 10 percent of the area and occurs in sloping convex ridges, moderately steep and very steep, smooth to uneven, moderately dissected sideslopes within the Udic-Mesic Zone.

The Preacher Series consists of deep well drained soils which have dark brown and very dark brown clay loam surface layers and yellowish brown clay loam subsoils. These soils make up about 40 percent of the association.

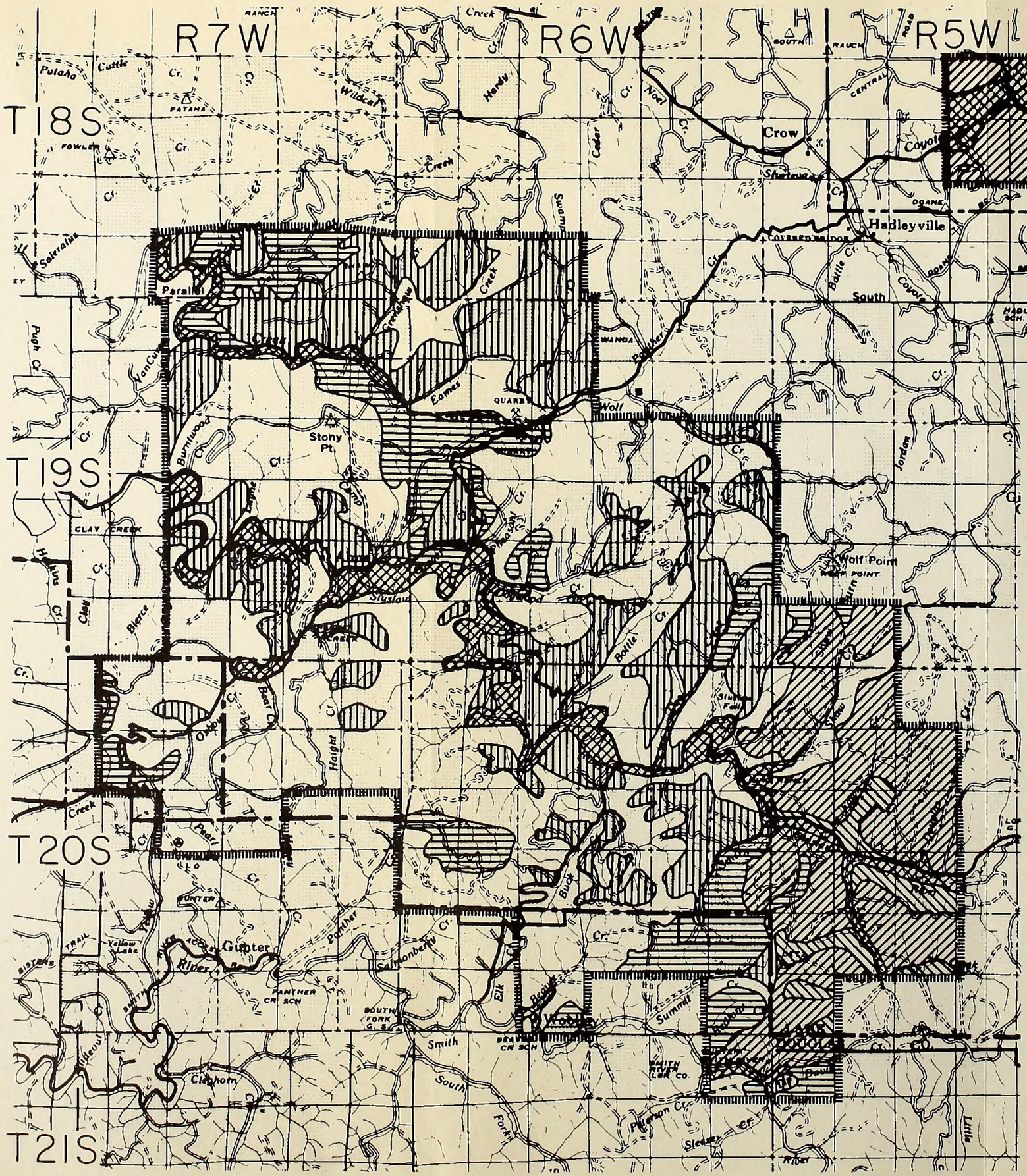
The Digger Series consists of moderately deep well drained soils which have dark grayish brown gravelly loam surface layers and brown very gravelly loam subsoils. Digger soils make up about 30 percent of the association area.

The Apt Series consists of deep well drained soils which have dark brown clay or clay loam surface layers and dark brown or yellowish brown clay or silty clay subsoils. Apt soils make up about 30 percent of the association area.

Honeygrove-Peavine Association, 3 to 60 percent slopes

This soil association comprises about 24 percent of the area and occurs on broad stable convex ridges, ridge noses, saddle positions, and on gently sloping to steep sideslopes in the Udic-Mesic Zone.

The Honeygrove Series consists of deep well drained soils which have dark reddish brown clay surface layers and dark red clayey subsoils. These soils make up about 70 percent of the association.




MILES
0 1 2 3

NATIONAL RESOURCE LANDS

ANALYSIS AREA BOUNDARY

SIUSLAW OIL AND GAS LEASING
ENVIRONMENTAL ANALYSIS RECORD

MAPPING UNIT *

MIXED ALLUVIAL LAND.

PREACHER - DIGGER - APT ASSOCIATION, 35 TO 90 PERCENT SLOPES.

HONEYGROVE - PEAVINE ASSOCIATION, 3 TO 60 PERCENT SLOPES.

DIGGER - JASON - PREACHER ASSOCIATION, 35 TO 90 PERCENT SLOPES.

JORY - BELLPINE - WILLAKENZIE ASSOCIATION, 3 TO 60 PERCENT SLOPES.

ATRING - NEKIA ASSOCIATION, 35 TO 90 PERCENT SLOPES.

PANTHER - HAZELAIR ASSOCIATION, 3 TO 35 PERCENT SLOPES.

DIXONVILLE - PHILOMATH ASSOCIATION, 10 TO 60 PERCENT SLOPES.

* THESE MAPPING UNITS COMPRISE A GROUPING OF MORE DETAILED MAPPING UNITS DESCRIBED IN REPORTS AVAILABLE IN THE EUGENE AND ROSEBURG B.L.M. DISTRICT OFFICES.

SOIL ASSOCIATIONS
MAP 5

The Peavine Series consists of moderately deep well drained soils which have dark brown silty clay loam surface layers and dark reddish brown and yellowish red silty clay subsoils. These soils make up about 30 percent of the association.

Intermingled with the Honeygrove and Peavine soils are inclusions of the deep, brown clayey Apt soils; the moderately deep brown gravelly loam Bohannon soils; and the moderately deep brown loamy skeletal Digger soils.

Digger-Jason-Preacher Association, 35 to 90 percent slopes

This soil association comprises about 43 percent of the area and occurs on moderately steep and steep, moderate to heavily dissected sideslopes, steep headwalls and escarpments within the Udic-Mesic Zone.

The Digger Series consists of moderately deep well drained soils which have dark grayish brown gravelly loam surface layers and brown very gravelly loam subsoils. They make up about 50 percent of the association.

The Jason Series consists of shallow well drained soils which have dark brown gravelly loam surface layers and brown very gravelly loam subsoils. They make up about 30 percent of the association area and are found on steep headwalls, slide escarpments and very steep convex sideslopes.

The Preacher Series consists of well drained soils which have dark brown and very dark brown clay loam surface layers and yellowish brown, clay loam subsoils. They make up about 20 percent of the association area and are found on moderate sloping convex ridges and smooth sideslopes.

Intermingled with this association are inclusions of moderately deep, red clayey Peavine soils found on ridgetops, saddles, and gentle to moderately steep smooth sideslopes and shallow brown loamy-skeletal Umpcoos soils are found intermingled with Jason soils in steep headwalls and slide escarpments which represent the remaining association area.

Jory-Bellpine-Willakenzie Association, 3 to 60 percent slopes

This soil association comprises about 13 percent of the area and occurs in the Zeric-Mesic Zone on broad stable, gently sloping convex ridge tops and ridge noses; sloping to steep convex sideslopes; and gentle to moderately sloping concave foothills in the eastern portion of the area. They overlie soft to moderately hard predominately incompetent sandstone bedrock.

The Jory Series consists of deep well drained soils which have dark reddish brown, silty clay loam surface layers and dark reddish brown silty clay or clay subsoils. These clayey soils comprise about 40 percent of the association.

The Bellpine Series consists of moderately deep, well drained soils which have dark reddish brown, silty clay loam surface layers and dark red silty clay or clay subsoils. These clayey soils make up about 35 percent of the association.

The Willakenzie Series consists of deep well drained soils which have dark brown silty clay loam or clay loam surface layers and dark brown silty clay loam subsoils. These fine-silty soils make up about 20 percent of the association.

The remaining portion of the association is occupied by inclusions of other soils. The predominate ones are the moderately deep well drained brown fine textured Dixonville soils; the moderately deep, well drained, red clayey-skeletal Ritner soils; the moderately deep, somewhat poorly drained, clayey Hazelair soils; and the moderately deep, well drained, red clayey Nekia soils.

The Dixonville soils have formed principally in valley-side alluvium an alluvial-colluvial deposit on the low foothills which are concave upward in cross section. Ritner soils and Nekia soils are found on the steeper sideslopes and narrow ridge crests. The Hazelair soils occur on slightly convex footslopes close to the valleys of the major tributaries.

Atring-Nekia-Association, 35 to 90 percent slopes

This soil association comprises about two percent of the area and occurs on moderately steep to steep mountainous slopes and gently sloping, stable, ridge tops and saddle positions in the Xeric-Mesic Zone.

The Atring Series consists of shallow well drained soils which have dark yellowish brown, gravelly silty loam surface layers and brown very gravelly silt loam subsoils. These soils comprise about 60 percent of the association. They are found on narrow convex ridge-tops and steep convex sideslopes.

The Nekia Series consists of well drained soils which have dark reddish brown, silty clay loam surface layers and dark reddish brown, silty clay or clay subsoils. They comprise about 40 percent of the association.

Panther-Hazelair Association, 3 to 35 percent slopes

This soil association comprises only 0.4 percent of the area and occurs in swales and concave slopes on low rolling footslopes and on smooth convex slopes in the Xeric-Mesic Zone.

The Panther Series consists of moderately deep, poorly drained soils with very dark brown silty clay loam surface soils and olive brown, mottled clay subsoils. These soils are saturated with water during the winter season. Panther soils make up about 60 percent of the association.

The Hazelair Series consists of moderately well to somewhat poorly drained soils which have dark brown silty clay loam surfaces and a dark brown silty clay or clay subsoil underlain by a light olive brown very plastic clay at 12 to 24 inches. These soils make up about 40 percent of the area and are most commonly found on nearly level to sloping smooth, convex sideslopes on the lower foothills.

Intermingled with the Panther and Hazelair soils are inclusions of the moderately deep, dark brown, fine-silty Willakenzie soils and the moderately deep, red, clayey Bellpine soils comprise the remaining area in the association.

Dixonville-Philomath Association, 10 to 60 percent slopes

This soil association comprises about two percent of the area and occurs on gently sloping to very steep smooth convex foothills in the Xeric-Mesic Zone.

The Dixonville Series consists of moderately deep, well-drained soils which have very dark brown silty clay loam surface layers and dark reddish-brown clay or silty clay subsoils. These soils make up about 70 percent of the association.

The Philomath Series consists of shallow, well drained soils with very dark brown, silty clay surface layers and very dark brown cobbly silty clay or clay subsoils. These soils comprise about 30 percent of the association.

Minor inclusions of well drained dark brown, cobbly clay loam Ritner soils occur on the ridges and the steeper slopes.

D. Erosion

Surface erosion. Surface erosion, particularly rate and severity, is difficult to quantify. Rainfall intensity and duration, percent and length of slope, soil particle size distribution, soil structure and permeability, land use and vegetative cover are all significant factors in determining a soils potential

"erosion hazard." These factors may operate independently or in concert to either lessen or increase this erosion potential. Although erosion rates vary in relation to these many site factors it is minimal on undisturbed forest land. This is largely attributable to the great value vegetative cover and forest floor litter has in reducing surface runoff and reducing soil particle detachment and transport. Removal of vegetative cover and destruction of the litter layers; which play such an extremely important role in absorption of precipitation and moderation of runoff, on the other hand, will lead to an increase in surface erosion.

The soils have been qualitively placed, as shown on the following table, in erosion hazard classes according to their tendency to have particles detached and transported by raindrop impact and surface runoff under bare soil conditions. The response tendency is based upon evaluations of areal climate, slope and soil characteristics. These hazard classes are described as follows:

(a) A low potential hazard rating indicates that insignificant soil loss is anticipated.

(b) A medium potential hazard rating indicates some precautions are needed to prevent appreciable soil loss.

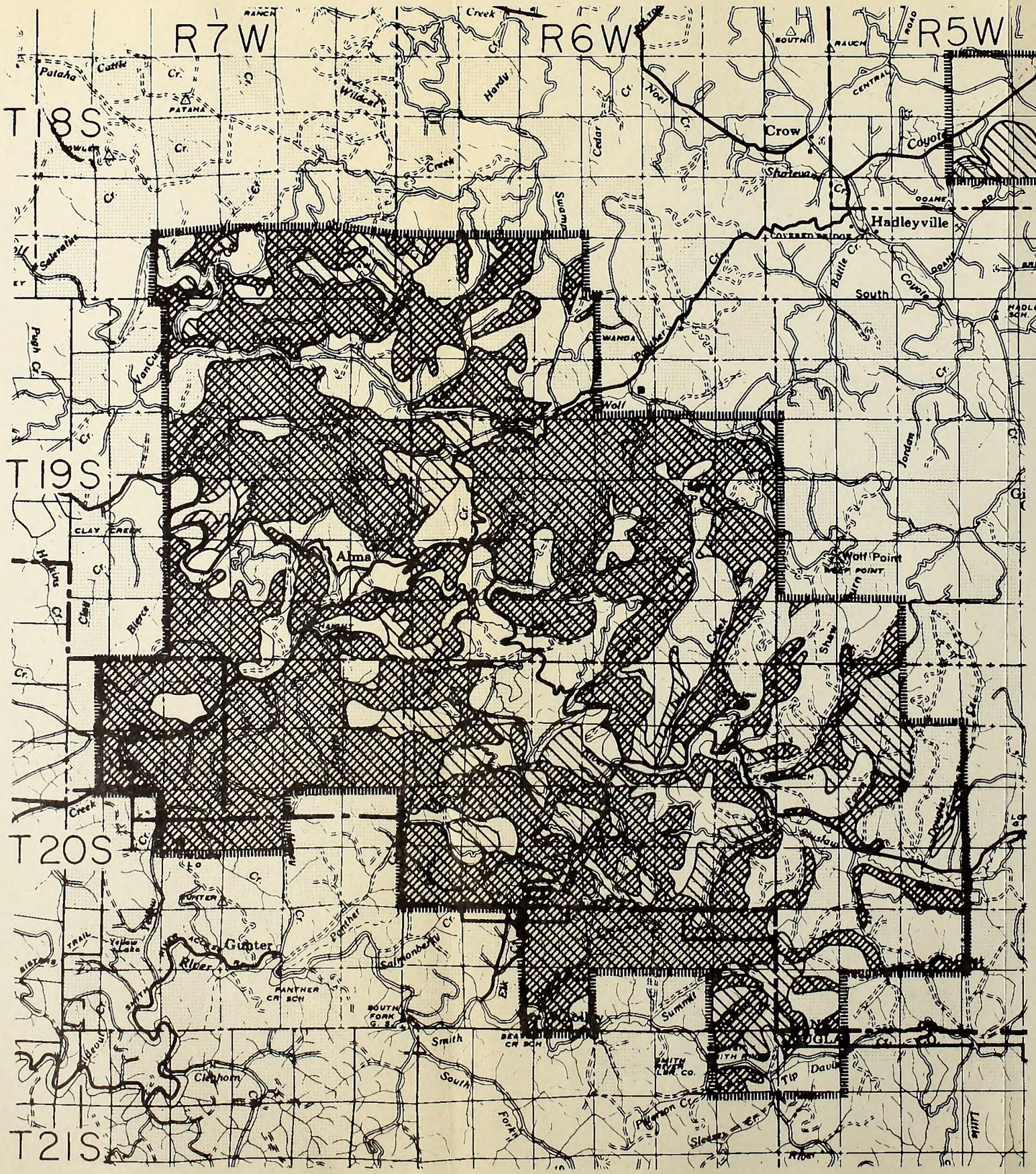
(c) A high potential hazard rating indicates that special management practies or treatments should be planned to minimize a severe soil loss.

Mass Soil Movement (landslides). This phenomena is the dominant erosion process in the area. It involves the interaction of slope gradient, bedrock, groundwater, soil depth and other soil physical properties.

Road building and timber cutting are effective initiators of slope failures.

The landslide events associated with road construction are initiated by factors that either contribute to high shear stress, such as fill embankments, or low shear strength such as excess groundwater, over steepening of natural slopes, or both. Those events occurring on steep denuded slopes, where not associated with road construction, have been identified with the deterioration of mechanical support provided by root systems in shallow soils.

The area has basically two characteristic types of landscapes, each of which exhibits different slope stability problems. So to facilitate differentiation between the two they are described




SIUSLAW OIL AND GAS LEASING
ENVIRONMENTAL ANALYSIS RECORD

EROSION AND LANDSLIDE HAZARD
MAP 6

as Type I and Type II. The Type I landscape is characterized by narrow ridges with steep and very steep slopes which are predominantly smooth and of uniform gradient from near the ridgetop to the valley floor and moderately to highly dissected by streams which often become extremely steep (100%+) in the upper reaches of the drainage or "headwall" positions. Road construction in these physiographic positions often initiate fast moving debris slides, avalanches, and flows which bury productive soils, destroy timber and scour streams. The soils on this landscape are predominantly the shallow loamy-skeletal Jason and Umpcoos series and the moderately deep loamy-skeletal Digger series which overlie massive, rhythmically bedded micaceous and arkosic sandstone with thin siltstone interbeds (Tyee Formation). The Type II landscape is characterized by rounded ridges and slopes with gradients ranging from less than 10 percent up to 70 to 80 percent and which are commonly broken by benches and have low to moderate stream dissection. The soils are predominantly the deep clayey Apt, Honeygrove or Jory series. They overlie the Tyee Formation also, but here it is soft, highly fractured, and moderately competent to locally incompetent. Slumps are the most common slope failure, but due to these factors - deeper soils, higher clay content, gentler slopes, and a gradual transition to bedrock makes this landscape more stable than described for the Type I.

Landslide inventories on the Tyee Formation conducted by the Eugene B.L.M. District Office and the U. S. Forest Service, Mapleton District has shown respectively that 81 percent and 97 percent of the total slide events which were associated with roads on the Type I landscape occurred on slopes greater than 60 percent. In addition, the B.L.M. study has shown that slide events associated with roads in the Type II landscape had failed on an average 43 percent slope as compared with the average 68 percent slope for slides in the Type I landscape.

The soils have been given a landslide hazard rating in the following table, but, for more detailed information, specific reports are available in the Eugene District Office.

See Map 6, entitled, Erosion and Landslide Hazard, which delineates areas with defined erosion hazards and unstable slopes.

# TABLE 2

## PROPERTIES, QUALITIES AND INTERPRETATIONS OF MAJOR SOIL SERIES

| Soil Series | Soil Depth 1) Inches | Hydro Group | Perme- 2) Ability Inches/hr. | Unified Class. (Subsoil) | Landslide Hazard 3) % Slope 35-60 | Landslide Hazard 3) % Slope 60% | Erosion Hazard 4) % Slope 35(-) | Erosion Hazard 4) % Slope 35-60 | Erosion Hazard 4) % Slope 60(+) | Compaction 5) Hazard | Site D. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Apt | 40 - 60 | C | .2 - .6 | MH | unstable | unstable | medium | high | .... | high | 1 |
| Bellpine | 20 - 40 | C | .06 - 0.2 | MH | mod. stable | unstable | medium | high | .... | high | 1 |
| Bohannon | 20 - 40 | B | 2.0 - 6.0 | SM | mod. stable | unstable | low | medium | high | medium | 1 |
| Digger | 20 - 40 | B | 2.0 - 6.0 | SM | mod. stable | unstable | low | medium | high | medium | 1 |
| Dixonville | 20 - 40 | C | .06 - 0.2 | CH | mod. stable | unstable | medium | high | .... | high | 1 |
| Hazelair | 24 - 40 (Dense Clay 15-30) | D | .06 - 0.2 | CH | unstable | unstable | high | .... | .... | high | . |
| Honeygrove | 40 - 60+ | C | .14 - .16 | MH | mod. stable | unstable | medium | high | .... | high | 1 |
| Jason | 12 - 20 | B | 2.0 - 6.0 | GM | mod. stable | unstable | low | medium | high | low | 1 |
| Jory | 40 - 60+ | C | .2 - .6 | CL | mod. stable | unstable | medium | high | .... | high | 1 |
| Nekia | 20 - 40 | C | .2 - .6 | CL | mod. stable | unstable | medium | high | .... | high | 1 |
| Atring | 20 - 40 | B | 2.0 - 6.0 | SM | mod. stable | unstable | low | medium | high | medium | 1 |
| Panther | 30 - 60 (Dense Clay 10-20) | D | 0.06 | CH | unstable | unstable | medium | .... | ..... | high | |
| Peavine | 20 - 40 | C | .2 - .6 | MH | mod. stable | unstable | medium | high | .... | high | |
| Philomath | 12 - 20 | D | .06 - 0.2 | CH | unstable | unstable | medium | high | high | high | |
| Preacher | 40 - 60+ | B | .6 - 2.0 | MH | mod. stable | unstable | low | medium | high | medium | |

TABLE 2

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Umpcoos | 12 - 20 | B | 2.0 - 6.0 | GM | unstable | unstable | low | medium | high | low | 105 |
| Ritner | 20 - 40 | C | .2 - .6 | GC | mod. stable | unstable | low | medium | high | medium | 136 |
| Willakenzie | 40 - 60+ | C | .2 - .6 | CL | mod. stable | unstable | medium | high | .... | high | 155 |



1) Depth is to Bedrock except as noted. Restrictions to rooting, other than water table, and the depths to them are shown in Parentheses. (Dense clay 10-20).

2) Rates are for least permeable layer.

3) Hazard ratings are based on field observations as to tendency to slump or slide when associated with road construction and denudation of slopes.

4) Based on bar soil surface.

5) Based on reduction of pore space which impedes root development and air and water movement.

6) Approximate medium value of plot data based on USDA 1949, Technical Bulletin No. 201.

D. Land Use

For purposes of discussing present land uses, the analysis area has been divided into two subareas. Map 7 shows these two subareas as well as the major land uses within each. Subarea 1 comprises the bulk of the analysis area and contains approximately 79,000 acres. Subarea 2, containing about 4,500 acres, combines the two smaller tracts northeast of Subarea 1 which are influenced by their proximity to the Eugene metropolitan area.

A. Subarea 1

The land ownership patterns within the analysis area are generally in large parcels. Approximately 38,000 acres (48%) is public land managed by the Bureau of Land Management. The private lands, intermingled with the public lands in a checkerboard pattern, are predominantly owned by lumber companies. Except for a few small agricultural areas along the Siuslaw and Smith rivers, the vast majority of both public and private ownerships are managed as commercial forest land. These commercial forest lands have a highly developed road system. An average of 2-3 miles of rocked forest roads and many lower standard spur roads in each section (640 acres) have been built to harvest and manage the timber resource.

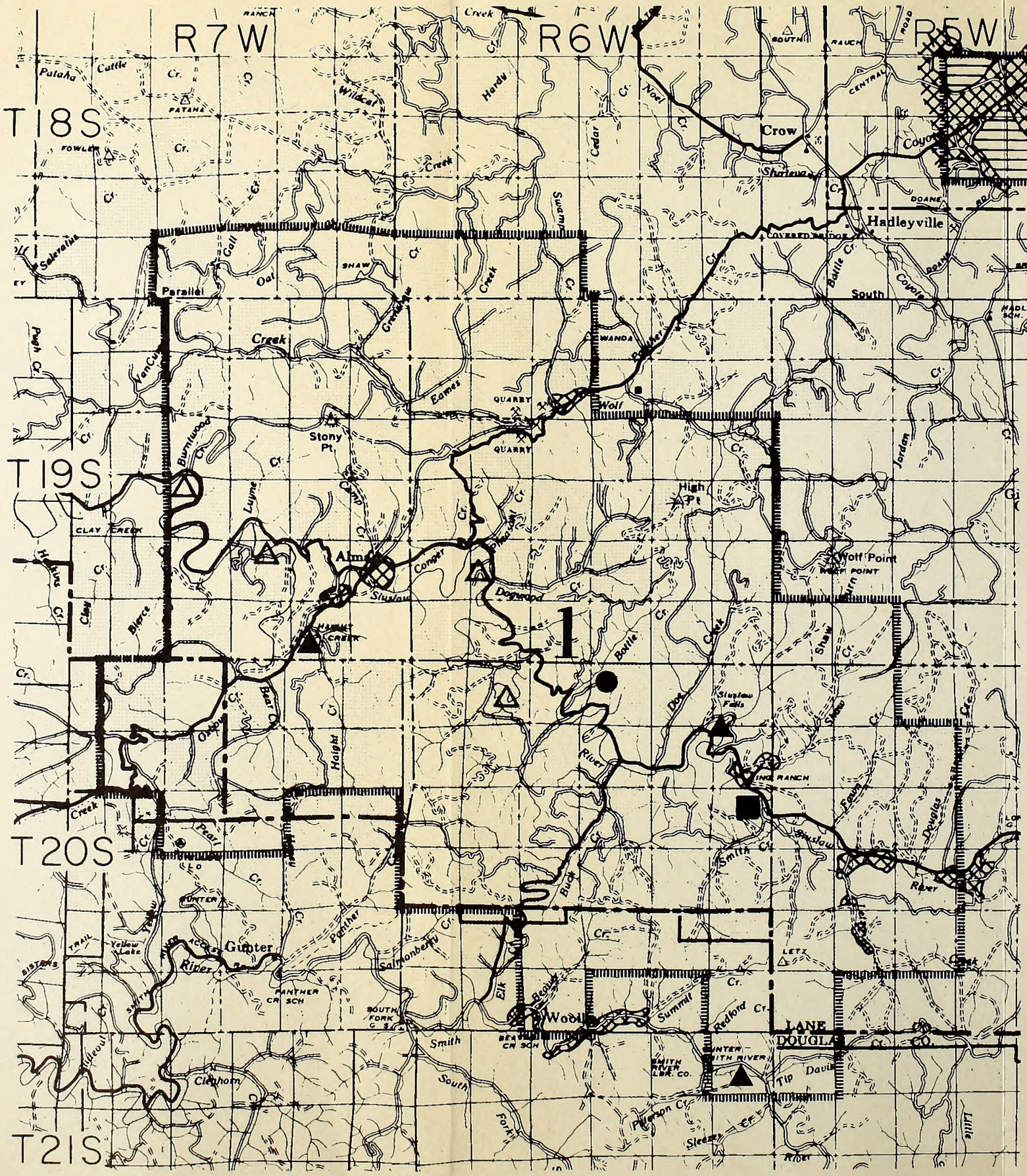
The subarea is sparsely settled with homesites scattered in the flatter stream valleys along major roads -- there are no specific concentrations or development nodes. Since population trends show a mixed history, with a net loss tabulated over the past 20 years, little change in population and development is projected through 1995(1).

B. Subarea 2

Historically, the lands within and adjacent to the subarea were used for timber production and pasture. More recently, reflecting the rapid population growth of Eugene, pressures for residential development have increased substantially. The larger sheep and cattle operations are being divided into part-time, 20-40 acre "ranchettes." Homesites of 1-10 acres are being developed in neighborhood clusters. The remaining forest lands are devoted to small tree farms.

The subarea is in a transition zone on the immediate periphery of the Eugene metropolitan area. Though development has been scattered and somewhat confused, there appears to be a definite trend toward intensified rural residential development.

(1) Preliminary Comprehensive Land Use Plan for the Siuslaw-Lake Creek Subarea, Technical Report, Lane County, Oregon, August 1974, pp. 3-7.


R7W
R6W
R5W
R4W
T18S
T19S
T20S
T21S
Hadleyville
Crow
Almo
Gunter
Wolf Point
Stony Pt.
High Pt.
Parallel
Burtonwood
Luyne
Conger
Daywood
Wolf
Quarry
Eames
Swanwanka
Battle Cr.
Coyote
Spencer
Bailey Hill
Murray Hill
Shotwell
Buck
Smith
Douglas
Redford Cr.
Summit
Elk
Beaver
Panther
Salmonberry
Pearl
Oak
Call
Cedar
Hardy
Wildcat
Noel
Creek
Cr.
River
Fork
Slough
Sleezy
Pierce
Clay
Haight
Bear Cr.
Clayhorn
Pleasant Cr.
Davis
Tip
Shaw
Dog
Little
Sluslaw Falls
Wolf Point
Hadleyville
Almo
Gunter
Woodl
Crow
Coyote
Bailey Hill
Murray Hill
Stony Pt.
High Pt.
1
2
MILES
0 1 2 3
NATIONAL RESOURCE LANDS
ANALYSIS AREA BOUNDARY
SIUSLAW OIL AND GAS LEASING
ENVIRONMENTAL ANALYSIS RECORD
TIMBER LANDS
AGRICULTURAL LANDS
RURAL WOODLAND & GRAZING
DEVELOPED RECREATION SITE
PAVED ROADS
GRAVEL ROADS
SEASONAL ROADS
NUTRITIONAL RESEARCH SITE
POTENTIAL RECREATION SITE
PROGENY PLANTATION
LAND USE
MAP 7

## WATER

The majority of the land area included within this analysis is contained within the boundaries of the "Coastal Sub-basin," the southerly portion of the Mid-coast Basin. Precipitation averages about 50 inches per year with 70 percent falling during the winter months of November through March. Most precipitation falls as rain; snow averages only about 8 inches per year in one or two inch occurrences of very short duration. A graph of the annual distribution at Cottage Grove, Oregon is shown by Figure 1. Though precipitation varies in relation to elevation, the annual distribution pattern for the analysis area remains similar to that of Cottage Grove. Precipitation begins to rapidly taper off in April, reaching a "trace" level in the mid-summer months. During this period, evaporation far exceeds rainfall, resulting in the usual summer drought.

### Surface Water

There are a myriad of small rivers and streams throughout the analysis area -- most tributary to one major river called the Siuslaw. The majority of these smaller drainages are characterized as swift mountain streams; many with gradients exceeding 150-200 feet per mile. The primary water source, especially for the smaller streams is run off which averages about 30 - 40 inches per year, or two thirds of the annual precipitation. The result is that many of these smaller drainages are intermittent, drying up in the droughty summer months. Those that continue to flow during the drier seasons are fed by springs far too numerous to attempt location. Since agricultural use is minimal and downstream municipal and industrial use is low, even summer flows are sufficient to meet present demands.

### Ground Water

Supplies, though of high quality, are generally quite limited in the majority of the analysis area. The upland aquifers, and many in the smaller valleys as well, are marine rocks which are characteristically dense, permitting very little infiltration, movement or storage. Yield estimates range from 2 to 10 gallons per minute. Along the Siuslaw River, the aquifers are alluvial sand and gravel with a much more adequate supply for domestic, farm and small commercial use -- yields average 50 to 200 gallons per minute of quality water.

### Water Pollution

Both surface and gound waters have few, if any, pollution problems. Surface waters occasionally experience periods of turbidity result-

ing from surface erosion. Such turbidity, associated with the wet winter season, is a common natural phenomenon aggrevated in varying degrees by resource management activities.

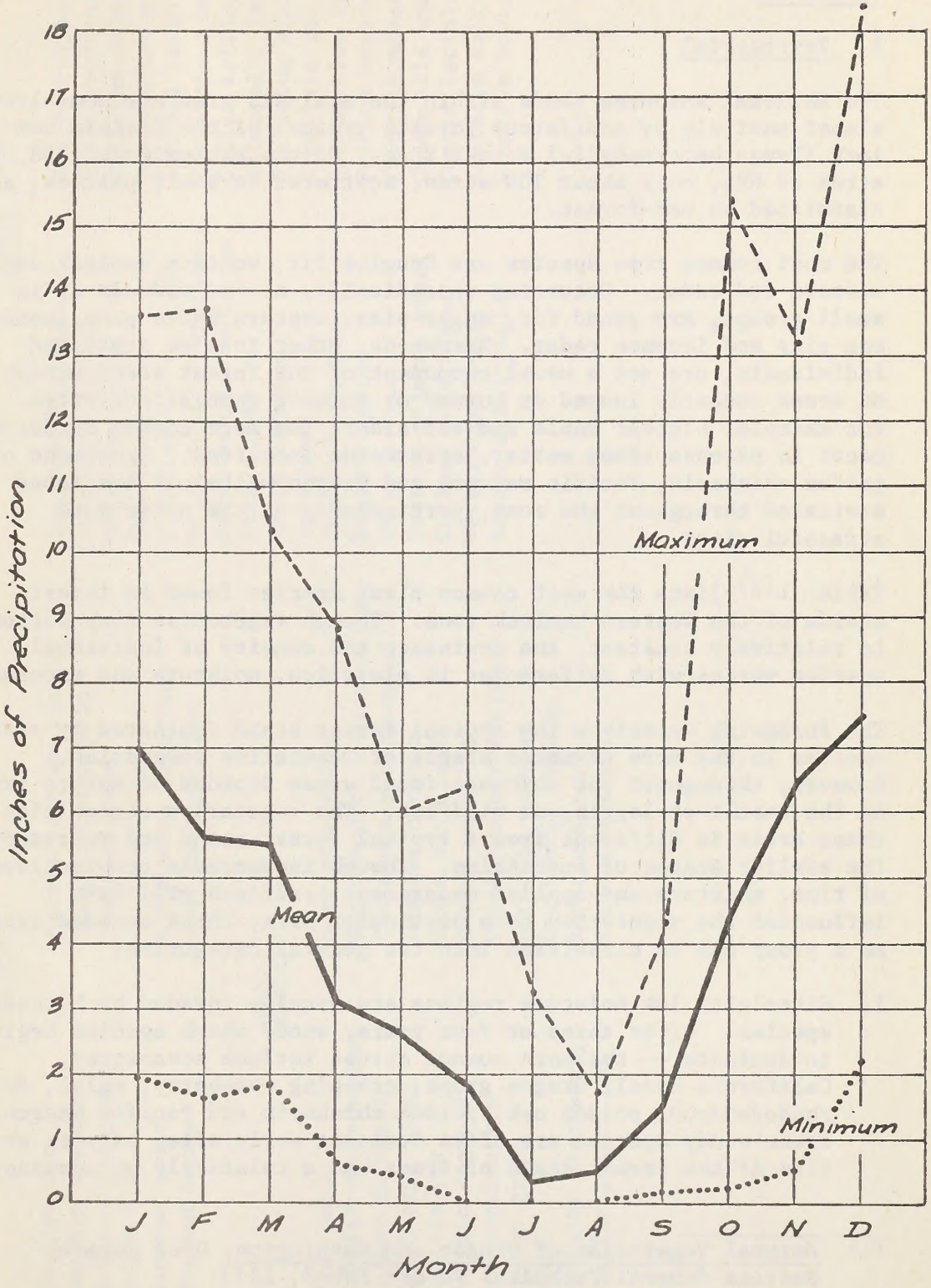
Though on site water pollution is generally minimal with no known significant point sources, it is imperative to note the fundamental "watershed role" of national resource lands in combination with the intermingled private lands. It is in such headwaters that man's activities must be in close harmony with natural systems to help insure downstream water quantity and quality.

More specific water quality data is provided in the Water Quality Report, published in January 1974 by the Lane Council of Governments.

Figure 1

# Monthly Precipitation

## Cottage Grove Weather Station




Source:

1969 Willamette Basin Comprehensive Study
Appendix B, Hydrology, Table II-8

## VEGETATION

### A. Terrestrial

The National Resource Lands within the analysis area are dominated almost entirely by coniferous forests typical of the Western hemlock (Tsuga heterophylla) Forest Zone. Of the approximately 38,094 acres of NRL, only about 100 acres, scattered in small patches, are classified as non-forest.

The most common tree species are Douglas fir, western hemlock and western red cedar. Occurring sporadically, as individuals or in small groups, are grand fir, sugar pine, western white pine, ponderosa pine and incense cedar. Hardwoods, other than as scattered individuals, are not a usual component of the forest stand except on areas recently logged or burned or on more specialized sites. For example, bigleaf maple and red alder, the more common hardwoods, occur in patches along wetter, streamside locations. Specimens of golden chinkapin, Pacific madrone and Oregon white oak are found scattered throughout the zone, particularly on the drier more stressful sites.

Table 3 (1) lists the most common plant species found in forest stands of the Western hemlock zone. Though vegetative composition is relatively constant, the dominance and density of individual species varies with differences in elevation, moisture and exposure.

The foregoing describes the typical forest stand dominated by tree species in the more advanced stages of vegetative succession. However, throughout the unit are found areas denuded of mature trees as the result of logging or wildfire. The vegetative composition on these areas is different from a typical forest stand and represents the earlier stages of succession. Though innumerable combinations of time, moisture and applied management practices will have influenced the vegetation on a particular site, these denuded areas as a group can be classified into two general categories.

1. Sites with low moisture regimes are usually invaded by herbaceous species. After three or four years, woody shrub species begin to dominate -- the more common shrubs include oceanspray, California hazel, Oregon grape, creeping snowberry, salal, Pacific rhododendron, poison oak, golden chinkopin and Pacific madrone. These woody species are often dominant early after harvest or fire if the former stand of trees had a relatively open canopy.

(1) Natural Vegetation of Oregon and Washington, USDA Forest Service General Technical Report PNW-8, 1973.

TABLE 3

| TREES | |
|---|---|
| Douglas fir | Pseudotsuga menziesii |
| Western hemlock | Tsuga heterophylla |
| Western red cedar | Thuja plicata |
| Grand fir | Abies grandis |
| Incense cedar | Libocedrus decurrens |
| Bigleaf maple | Acer macrophyllum |

| SHRUBS | |
|---|---|
| Vine maple | Acer circinatum |
| Pacific Rhododendron | Rhododendron macrophyllum |
| Golden chinkapin | Castanopsis chrysophylla |
| California hazel | Corylus cornuta |
| Western yew | Taxus brevifolia |
| Pacific dogwood | cornus nuttallii |
| Red huckleberry | Vaccinium pervifolium |
| Oregon grape | Berberis nervosa |
| Salal | Gaultheria shallon |
| Trailing blackberry | Rubus ursinus |
| Pacific poison oak | Rhus diversiloba |

| HERBS | |
|---|---|
| Deerfoot Vanillaleaf | Achlys triphylla |
| Evergreen Violet | Viola sempervirens |
| White trillium | Trillium ovatum |
| Swordfern | Polystichum munitum |
| Twinflower | Linnaea borealis |
| White inside-out-flower | Vancouveria hexandra |
| Sweet scented bedstraw | Galium triflorum |
| Star flower | Trientalis latifolia |
| White hawkweed | Hieracium albiflorum |
| Snowqueen | Synthyris reniformis |
| Common beargrass | Xerophyllum tenax |
| Western Fescue | Festuca occidentalis |
| Whipple vine | Whipplea modesta |
| Western princes pine | Chimaphila umbellata |
| Cutleaf goldthread | Coptis laciniata |
| Western coolwort | Tiarella unifoliata |
| Hooker's fairybells | Disporum hookeri |

2. Sites with higher moisture regimes are characteristically dominated by moisture loving species commonly associated with the original forest stand. If the previous stand had a closed canopy, the area will tend to be dominated by herbaceous species such as swordfern, twinflower and Oregon Oxalis. If the canopy was relatively open, the vegetation will consist of the above herbs together with woody plants such as red alder, bigleaf maple, vine maple, western hemlock, salmonberry, thimbleberry and huckleberry.

Obviously, these two general categories do not include all plants that may be found in any given area. Many additional species may be found sporadically or even in abundance under specific conditions.

Poisonous and noxious plants are abundant from a clinical standpoint, but two species, poison oak and tansy ragwort, have significant economic importance.

Pacific poison oak (Rhus diversiloba) is a woody vine-like plant abundantly common on drier south and west exposures throughout Western Oregon. It's oily secretions cause a severe, itching rash which is considered an "occupational hazard" among foresters and loggers.

Tansy ragwort (Senecio jacobaea) is becoming a major agricultural problem as it continues to spread over cut over forest lands and hill pastures. Over 500,000 acres of Western Oregon have been infested with a weed since its introduction about 50 years ago. Tansy is a poisonous plant which causes production loss, severe liver damage and death among several domestic animal species. Cattle and horses are most commonly affected, with verified cases of poisoning among swine and sheep. Newly logged areas and recently disturbed soil from road construction are prime locations for infestation. Once introduced, an abundant seed source is established which economically defies traditional methods of control -- herbicide and cultivation. Without a practical control, surrounding agricultural lands are subject to continual reinfestations. Several biological controls are in the testing stage, but a definative evaluation will require several more years.

B. Aquatic

With the exception of seasonal swamps and ponds the aquatic environment within the analysis area is a running (lotic) or stream type as opposed to a standing type. Thus, current, cooler water, lower nutrient content and less available sunlight limit aquatic vegetation

to willows, filamentous algae and periphyton. But the totality of the vegetative component of the aquatic environment is comprised of more than just submersed vegetation -- Terrestrial plants are a crucial link. The typical fauna of the lotic system are "debris" feeders, highly dependent upon organic materials which drop into the stream from adjacent vegetation. Because they are an integral part of the aquatic system most plant species listed on Table 3 should be considered as aquatic vegetation as well as terrestrial.

C. Rare or Endangered

Available reserach, sketchy at best, describes few rare, unique or endangered plants indigenous to the analysis area. The following is a list of plants, apparently limited in range to the coastal mountains, which are considered by some as "possibly" rare and/or endangered:

| | |
|---|---|
| Cardamine pattersonii | Filipendula occidentalis |
| Cardamine penduliflora | Saxifraga occidentalis |
| Cirsium hallii | Sidalcea hirtipes |

Though scattered individuals of such plants are undoubtedly found throughout the area, there are no known significant concentrations.

ANIMALS

A. Terrestrial

Wildlife in the lease area is outstanding in terms of both populations and numbers of species. This condition is due to the vast array of habitats available. These habitats, all of which are found on BLM land, are as follows:

1. Rock outcrops and cliffs.
2. Natural opening dominated by herbaceous vegetation.
3. Dry-site hardwood stands of madrone and Oregon white oak.
4. Moist-site hardwood stands of alder and bigleaf maple.
5. Logged or burned coniferous forest land now dominated by herbs and brush.
6. Young-immature coniferous forest; generally 30-50 year age classes.
7. Young-mature coniferous forest; generally 80-150 yr. age classes.
8. Old-growth coniferous forest; generally above 250 years.
9. The Siuslaw River and scores of tributaries.
10. Riparian vegetation.

Habitats 1-5 above are lumped into a "major" habitat labeled "forest opening" in the following table summarizing wildlife-habitat relationships. Species listed in the table include all mammals, reptiles and amphibians known, or believed, to occur on BLM land in the lease area. Birds listed are known to nest, or winter, regularly on BLM land in the lease area. Since the table indicates major habitat uses only, it should not be considered a precise representation of field conditions. Any listed species may, for example, make casual use of one or more habitats in a manner not identified.

The majority of birds and mammals listed under "old-growth forest" in the table are dependent upon snags and decadent green trees for one or more needs. Most of these same species occur in "young-mature forests" where smaller snags are available; ie, in stands that have not received commercial thinnings or mortality salvage operations. Small wildlife species such as chickadees and brown creepers are therefore likely to be as abundant in one habitat as the other while larger species such as pileated woodpeckers will be less common in the younger habitat. The Northern spotted owl has the most exacting requirements of any species with respect to old-growth. The old-growth forest also provides excellent cover for elk, deer, bear and cougar. The quality of cover generally decreases with stand age.

Forest openings provide habitat for many species that seldom, if ever, use the forested habitats; examples being nighthawks and wrentits. Other species, such as deer and elk, use openings for foraging during excursions from cover in the forested habitats.

TABLE 4

ESTIMATED HABITAT USE BY SELECTED WILDLIFE SPECIES

| Species | Old Growth Forest | Young Mature Forest | Young Immature Forest | Forest Opening | Streams & Riparian Vegetation |
|---|---|---|---|---|---|
| BIRDS | | | | | |
| Pied-billed Grebe | | | | | 1-A |
| Great Blue Heron | 2-N | 2-N | | | 2-F |
| Mallard | | | | | 1-A |
| * Wood Duck | 1-N Near streams | | | | 2-F |
| * Hooded Merganser | 1-N Near streams | | | | 1-F |
| * American Merganser | 1-N Near streams | | | | 1-F |
| Turkey Vulture | 2-A | 2-A | 2-F | 2-F | 2-R,F |
| Sharp-shinned Hawk | 2-A | 2-A | 2-F | 2-F | 2-F |
| Coopers Hawk | 2-A | 2-A | 2-F | 2-F | 2-F |
| Red-tailed Hawk | 2-N,R,P | 2-N,R,P | | 2-F | 2-R,F |
| * Osprey | 1-N | 1-N | | | 1-A |
| * American Kestrel | | | | 2-F | 2-A |

*Snags, or decadent green trees, important to these species for nesting, feeding, denning or roosting.

Abundance

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Major Habitat Uses

A = All life needs
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TABLE 4

ESTIMATED HABITAT USE BY SELECTED WILDLIFE SPECIES

| Species | Old Growth Forest | Young Mature Forest | Young Immature Forest | Forest Opening | Streams & Riparian Vegetation |
|---|---|---|---|---|---|
| BIRDS (Continued) | | | | | |
| Blue Grouse | 2-A | 2-A | | | |
| Ruffed Grouse | 2-P,E | 2-P,E | 2-P,N,E | 2-F | 2-N,F,P,E |
| California Quail | | | 2-E,P | 2-A | 2-N,F,P,E |
| Mountain Quail | 1-A | 1-A | 1-A | | |
| Spotted Sandpiper | | | | | 2-A |
| Band-tailed Pigeon | 2-N,R,E | 2-N,R,E | | 2-F | 2-F,E |
| Morning Dove | | | | 2-A | 2-A |
| * Barn Owl | 1-A | 1-A | 1-F | 1-F | 1-A |
| * Screech Owl | | | | | 2-A |
| Great Horned Owl | 2-A | 2-A | 2-A | 2-F | 2-A |
| * Pygmy Owl | 2-A | 2-A | 2-F | 2-F | 2-A |
| * Spotted Owl | 2-A | 1-F | 1-F | | 1-F |

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| Species | Old Growth Forest | Young Mature Forest | Young Immature Forest | Forest Opening | Streams & Riparian Vegetation |
|---|---|---|---|---|---|
| BIRDS (Continued) Willow Flycatcher | | | | 1-A Near wet areas | 1-A |
| Hammond's Flycatcher | 1-A | 1-A | | | |
| Western Flycatcher | 2-A | 2-A | 2-A | | 2-A |
| Western Wood PeWee | 2-A | 2-A | | | |
| Olive-sided Flycatcher | 1-A | 1-A | 1-A | 1-A | |
| * Violet-green Swallow | 3-A Near water | 3-A Near water | | | 3-A |
| * Tree Swallow | 3-A Near water | 3-A Near water | 3-F | 3-F | 3-A |
| Bank Swallow | | | | 1-F | 1-A |
| Cliff Swallow | | | | 3-F | 3-F |
| * Purple Martin | 1-A Near water | 1-A Near Water | | | 1-A |
| Stellers Jay | 2-A | 2-A | 2-A | 2-F | 2-F |
| Scrub Jay | | | 2-A | 2-A | 2-A |
| Common Raven | 1-A | 1-A | 1-F | 1-F | 1-F |

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| Species | Old Growth Forest | Young Mature Forest | Young Immature Forest | Forest Opening | Streams & Riparian Vegetation |
|---|---|---|---|---|---|
| BIRDS (Continued) Common Crow | | | 2-A | 2-A | 2-A |
| * Black-capped Chickadee | | | 2-A | 2-A | 2-A |
| * Chestnut-backed Chickadee | 2-A | 2-A | 1-A | 1-F | |
| Bushtit | 1-A | 1-A | 1-A | 1-A | 1-A |
| * White-breasted Nuthatch | | | | 1-A Oak woods | 1-A |
| * Red-breasted Nuthatch | 2-A | 2-A | 1-F | | |
| * Brown Creeper | 2-A | 2-A | | | |
| Wrentit | | | | 2-A | 2-A |
| Dipper | | | | | 1-A |
| * House Wren | | | | 1-A | 1-A |
| Winter Wren | 2-A | 2-A | 2-A | 1-A | 1-A |
| * Bewicks Wren | | | | 2-A | 2-A |
| Rock Wren | | | | 1-A Rock outcrops | |

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| Species | Old Growth Forest | Young Mature Forest | Young Immature Forest | Forest Opening | Streams & Riparian Vegetation |
|---|---|---|---|---|---|
| BIRDS (Continued) Robin | | | | 3-A | 3-A |
| Varied Thrush | 2-A | 2-A | 2-A | | 2-F |
| Hermit Thrush | 2-A | 2-A | 2-A | | 1-F |
| Swainson's Thrush | 2-A | 2-A | 2-A | | 1-F |
| Western Bluebird | | | | 1-A | 1-A |
| Ruby-crowned Kinglet | 2-A | 2-A | 2-A | 1-F | 1-F |
| Golden-crowned Kinglet | 2-A | 2-A | 2-A | 1-F | 1-F |
| Cedar Waxwing | 2-A | 2-A | 2-A | 2-F | 2-F |
| Hutton's Vireo | 1-A | 1-A | 1-A | 1-F | 1-A |
| Solitary Vireo | 1-A | 1-A | 1-A | 1-F | 1-A |
| Warbling Vireo | | | 2-A | 2-A | 2-A |
| Orange-crowned Warbler | | | | 2-A Forest edge | 2-A |
| Nashville Warbler | | | | 2-A Forest edge | 2-A |

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| Species | Old Growth Forest | Young Mature Forest | Young Immature Forest | Forest Opening | Streams & Riparian Vegetation |
|---|---|---|---|---|---|
| BIRDS (Continued) | | | | | |
| Yellow-rumped Warbler | 2-A | 2-A | 1-A | 1-F | 1-F |
| Black-throated Gray Warbler | 1-A | 1-A | 1-A | 1-A | 1-A |
| Hermit Warbler | 2-A | 2-A | 1-A | 1-F | 1-F |
| MacGillivray's Warbler | | | | 2-A | 2-A |
| Common Yellow Throat | | | | 2-A Wet areas | 2-A |
| Yellow-breasted Chat | | | | 1-A Wet areas | 1-A |
| Wilson's Warbler | | | | 2-A Wet areas | 2-A |
| Western Meadowlark | | | | 1-A | |
| Red-winged Blackbird | | | | | 1-A |
| Northern Oriole | | | | 1-A | 1-A |
| Brewer's Blackbird | | | | | 2-A |
| Brown-headed Cowbird | | | | 1-A | 1-A |
| Western Tanager | 2-A | 2-A | 2-A | 2-F | 2-F |

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| Species | Old Growth Forest | Young Mature Forest | Young Immature Forest | Forest Opening | Streams & Riparian Vegetation |
|---|---|---|---|---|---|
| BIRDS (Continued) | | | | | |
| * Saw-Whet Owl | 1-A | 1-A | 1-F | 1-F | 1-A |
| Common Nighthawk | | | | 2-A | |
| * Vaux's Swift | 2-A | 2-A | | | 2-A |
| Rufus Hummingbird | | | | 3-A | 3-A |
| Belted Kingfisher | | | | | 2-A |
| * Common Flicker | 2-A | 2-A | | 2-F | 2-F |
| * Pileated Woodpecker | 2-A | 1-A | | | 2-F |
| * Acorn Woodpecker | | | | 2-A Oak Woods | |
| * Yellow-bellied Sapsucker | 1-A | 1-A | | 1-F | 1-F |
| * Hairy Woodpecker | 1-A | 1-A | 1-F | | 1-F |
| * Downy Woodpecker | | | | 2-A | 2-A |
| Western Kingbird | | | | 1-A | 1-A |

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| Species | Old Growth Forest | Young Mature Forest | Young Immature Forest | Forest Opening | Streams & Riparian Vegetation |
|---|---|---|---|---|---|
| BIRDS (Continued) | | | | | |
| Black-headed Grosbeak | 1-A | 1-A | 1-A | 2-A | 2-A |
| Lazuli Bunting | | | | 1-A | |
| Evening Grosbeak | 1-A | 1-A | 1-A | 3-F | 3-F |
| Purple Finch | 2-A | 2-A | 2-A | 2-F | 2-F |
| House Finch | 2-A | | | 1-A | |
| Pine Siskin | 2-A | 2-A | 2-A | 2-F | 2-F |
| American Goldfinch | | | | 2-A | |
| Lesser Goldfinch | | | | 1-A | |
| Red Crossbill | 1-A | 1-A | 1-A | | |
| Rufus-sided Towhee | | | | 3-A | 3-A |
| Savannah Sparrow | | | | 1-A | |
| Vesper Sparrow | | | | 1-A | |
| Dark-eyed Junco | 2-A | 2-A | 2-A | 3-F | 2-F |

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| Species | Old Growth Forest | Young Mature Forest | Young Immature Forest | Forest Opening | Streams & Riparian Vegetation |
|---|---|---|---|---|---|
| BIRDS (Continued) Chipping Sparrow | | | | 2-A | 2-A |
| White-crowned Sparrow | | | | 3-A | 3-A |
| Golden-crowned Sparrow | | | | 3-A Winter only | 3-A Winter only |
| White-throated Sparrow | | | | 1-A Winter only | 1-A Winter only |
| Fox Sparrow | | | | 3-A Winter only | 3-A Winter only |
| Lincoln's Sparrow | | | | 1-A Wet area & Winter only | 1-A Winter only |
| Song Sparrow | | | | 3-A | 3-A |
| | | | | | |
| Total Birds | 55 | 52 | 63 | 77 | 89 |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

*Snags, or decadent green trees, important to these species for nesting, feeding, denning or roosting.

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| Species | Old Growth Forest | Young Mature Forest | Young Immature Forest | Forest Opening | Streams & Riparian Vegetation |
|---|---|---|---|---|---|
| MAMMALS | | | | | |
| Opossum | | | | 4-A | 4-A |
| Trowbridge Shrew | 4-A | 4-A | 4-A | 4-A | 4-A |
| Vagrant Shrew | 4-A Along streams | 4-A Along streams | 4-A Along streams | 4-A Along streams | 4-A |
| Dusky Shrew | 4-A | 4-A | 4-A | | 4-A |
| Pacific Shrew | 4-A | 4-A | 4-A | | |
| Pacific Water Shrew | | | | | 4-A |
| Shrew Mole | | | | | 4-A |
| Townsend Mole | 4-A Moist areas | 4-A Moist areas | 4-A Moist areas | 4-A Moist areas | 4-A |
| Pacific Mole | 4-A Well drained soils | 4-A Well drained soils | 4-A Well drained soils | 4-A Well drained soils | |
| * Little Brown Myotis | 4-D | 4-D | | | |
| * Yuma Myotis | 4-D | 4-D | | | |
| * Long-eared Myotis | 4-D | 4-D | | | |

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| Species | Old Growth Forest | Young Mature Forest | Young Immature Forest | Forest Opening | Streams & Riparian Vegetation |
|---|---|---|---|---|---|
| MAMMALS (Continued) | | | | | |
| * Northern Flying Squirrel | 3-A | 3-A | | | |
| Mazama Pocket Gopher | | | | 4-A | |
| Camas Pocket Gopher | | | | 4-A | |
| Beaver | | | | | 3-A |
| Deer Mouse | 3-A | 3-A | 3-A | 3-A | |
| Dusky-footed Woodrat | 4-A | 4-A | 4-A | 4-A | |
| Bushytail Woodrat | 4-A | 4-A | 4-A | 4-A | 4-F |
| Pacific Phenacomy | 4-A Near streams | 4-A Near streams | 4-A Near streams | | |
| Tree Phenacomy (Red Tree Mouse) | 4-A | 4-A | | | |
| California Redback Vole | 4-A Moist areas | 4-A Moist areas | 4-A Moist areas | | |
| California Vole | | | | 4-A | |
| Townsend Vole | | | | 4-A Moist areas | |
| Longtail Vole | | | | 4-A Near water | |

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ESTIMATED HABITAT USE BY SELECTED WILDLIFE SPECIES

| Species | Old Growth Forest | Young Mature Forest | Young Immature Forest | Forest Opening | Streams & Riparian Vegetation |
|---|---|---|---|---|---|
| MAMMALS (Continued) Oregon Vole | 4-A Dry slopes | 4-A Dry slopes | 4-A Dry slopes | 4-A Dry slopes | |
| Gray-tailed Vole | | | | 4-A | |
| Muskrat | | | | | 4-A |
| Pacific Jumping Mouse | 4-A | 4-A | 4-A | 4-A | 4-A |
| Porcupine | 4-A | 4-A | 4-A | 4-F | 4-F |
| Nutria | | | | | 4-A |
| Snowshoe Hare | 4-A | 4-A | 4-A | 4-A | 4-F |
| Brush Rabbit | | | | 4-A | 4-F |
| Roosevelt Elk | 1-R,E,P | 1-R,E,P | 1-E | 1-F | 1-R,E |
| Black-tailed Deer | 1-R,E,P | 1-R,E,P | 1-R,E,P | 1-F | 1-R,E |
| | | | | | |
| Total Mammals | 42 | 42 | 26 | 35 | 31 |
| | | | | | |

*Snags, or decadent green trees, important to these species for nesting, feeding, denning or roosting.

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| Species | Old Growth Forest | Young Mature Forest | Young Immature Forest | Forest Opening | Streams & Riparian Vegetation |
|---|---|---|---|---|---|
| MAMMALS (Continued) | | | | | |
| * Longtail Weasel | 4-A Near water | 4-A Near water | 4-A Near water | 4-A Near water | 4-F |
| Mink | 4-A Near water | 4-A Near water | 4-A Near water | 4-A Near water | 4-F |
| River Otter | | | | | 4-A |
| Spotted Skunk | | | | 4-A | 4-F |
| * Striped Skunk | | | | 4-A | 4-F |
| Coyote | 2-A | 2-A | 2-A | 2-A | 2-A |
| Red Fox | 4-A | 4-A | 4-A | 4-A | 4-A |
| Gray Fox | 4-A | 4-A | 4-A | 4-A | 4-A |
| Mountain Lion | 1-A | 1-A | 1-A | 1-F | 1-F |
| * Bobcat | 2-A | 2-A | 2-A | 2-F | 2-F |
| Mountain Beaver | | | | 4-A Moist areas | 4-A |
| California Ground Squirrel | | | | 2-A Dry areas | |
| * Western Gray Squirrel | | | | 1-A | |

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| Species | Old Growth Forest | Young Mature Forest | Young Immature Forest | Forest Opening | Streams & Riparian Vegetation |
|---|---|---|---|---|---|
| MAMMALS (Continued) | | | | | |
| * Fringed Myotis | 4-D | 4-D | | | |
| * Long-legged Myotis | 4-D | 4-D | | | |
| * California Myotis | 4-D | 4-D | | | |
| * Small-footed Myotis | 4-D | 4-D | | | |
| * Silver-haired Bat | 4-D | 4-D | | | |
| * Big Brown Bat | 4-D | 4-D | | | |
| * Hoary Bat | 4-D | 4-D | | | |
| * Western Big-eared Bat | 4-D | 4-D | | | |
| * Pallid Bat | 4-D | 4-D | | | |
| * Black Bear | 2-D,E,P | 2-D,E,P | 2-F | 2-F | 2-F |
| * Racoon | 2-D Along streams | 2-D Along streams | | | 2-A |
| * Marten | 1-A | 1-A | | | |
| * Shorttail Weasel | 4-A Near water | 4-A Near water | 4-A Near water | 4-F Near water | 4-F |

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ESTIMATED HABITAT USE BY
SELECTED WILDLIFE SPECIES

| Species | All Coniferous Forests | Forest Openings | Streams & Riparium Vegetation |
|---|---|---|---|
| REPTILES AND AMPHIBIANS | | | |
| Northwestern Salamander | May be found up to 1 mile from water in these habitats. | | Spawns in permanent ponds and lakes |
| Western Long-toed Salamander | Found in these habitats in Willamette Valley | | In ponds during winter |
| Pacific Giant Salamander | In wet or damp forests | In wet or damp woods (alder) | Common along rocky shores, & in cold streams & lakes. |
| Olympic Salamander | | | In & along edges of gravelly, cold streams. |
| Rough-skinned Newt | Terrestrial stage found in these habitats | | Found in ponds, lakes & streams during breeding stage. |
| Dunn's Salamander | On stabilized, moist talus slopes. | | In and under moss-covered rocks & logs around springs & strea |
| Western Red-backed Salamander | Damp rocky locations. Also logs & bark | Damp rocky locations. Also logs & bark | |
| Oregon Slender Salamander | Damp forests | Damp woods | |
| Clouded Salamander | Throughout forests but tends to favor dry area | Favors dry woods | |
| Tailed Frog | During wet season | During wet season (Maple & Alder woods) | Clear cold, rocky streams. |

TABLE 4

ESTIMATED HABITAT USE BY
SELECTED WILDLIFE SPECIES

| Species | All Coniferous Forests | Forest Openings | Streams & Riparium Vegetation |
|---|---|---|---|
| REPTILES & AMPHIBIANS (Continued) | | | |
| Western Toad | May be found in these habitats near lakes and ponds. | | In and along edges of aquatic habitats. |
| Pacific Tree Frog | Near ground in vegetation near water | Near ground in vegetation near water | Marshes, lakes, and ponds & slow streams. |
| Red-legged Frog | Ocassionally in damp forests | Occasionally in damp woods | Found in still or slow moving water around aquatic vegetation, during breeding season in late winter. |
| Spotted Frog | | | In and near permanent marshy lakes and ponds. |
| Foothill Yellow-legged Frog | | | In streams with rocky, or clean stony bottoms. |
| Bullfrog | | | In quiet, permanent water around aquatic vegetation. |
| Western Pond Turtle | | | Ponds, marshes, rivers, streams with mud bottoms around aquatic vegetation |
| Western Fence Lizard | | Dry areas around rocks, bldgs, and wood piles. | |
| Western Skink | | In rocky, warm, dry areas. | |
| Southern (Oregon) Alligator Lizard | | Dry woods (oak) | |

TABLE 4

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SELECTED WILDLIFE SPECIES

| Species | All Coniferous Forests | Forest Openings | Streams & Riparium Vegetation |
|---|---|---|---|
| REPTILES & AMPHIBIANS (Continued) | | | |
| Northern Alligator Lizard | | Damp brushfields and woods. (Alder) | |
| Rubber Boa | In well drained forests, brushland and woods. | In well drained forests, brushland and woods. | |
| Ringneck Snake | | Dry slopes | |
| Sharp-tailed Snake | | Warm, dry areas | |
| Racer | | Light brush areas | |
| Gopher Snake | | Variety of habitat | |
| Common Garter Snake | Moist habitat near water | Moist habitat near water | Variety of habitats |
| Western Terrestrial (Mtn.) Garter Snake | | Variety of habitat | |
| Northwestern Garter Snake | Moist areas | Moist areas | |
| Western Rattlesnake | Variety habitats, favors south oak slopes and rock outcrops. | | |
| Total Amphibious & Reptiles | 16 | 24 | 15 |

Riparian vegetation was considered in the preceding table as that vegetation growing in areas subject to annual flooding. It therefore provides many needs for a host of wildlife species during the late spring and summer months.

Throughout the analysis area wildlife is most abundant where two or more habitats intersect. Commonly known as "edge," this area provides the greatest possible range of environmental needs in the shortest possible distance -- especially if close to water. Forest edge is abundant and widespread throughout the analysis area.

Endangered and threatened wildlife species that use, or may possibly use the analysis area are as follows:

1. Northern bald eagle - Considered "threatened" by State of Oregon. Regularly observed in analysis area. Nearest known nest is several miles west of analysis area.

2. Northern spotted owl - Considered "threatened" by State of Oregon due to its apparent need for large tracts of old-growth forest. Areas where this species is known to occur are shown on the wildlife map. (Map 8)

3. Peregrine Falcon (American & Arctic) - Listed as "endangered" by U. S. Department of the Interior. May possibly occur in analysis area during migration.

The following is a brief summary of habitat requirements of principle mammal and bird species found in the analysis area:

## MAMMALS

### Shrews and Moles

Shrews and moles are an important part of the forest environment due to their beneficial role as soil developers. (Wilde 1958) Since shrews and moles are known to feed extensively on adult insects and their larvae and pupae, they undoubtedly contribute to a dampening of population explosions of some "destructive" species. (Ingles 1965)

Shrews are present both above and below ground in a variety of habitats that provide vegetative ground cover, rotten logs, slash and debris. (Hooven 1969) Moles, however, are strictly subterranean and require soils usually considered as deep, rich and productive. (Wilde 1968)

### Bats

Since all bats in the Pacific Northwest are insectivorous, they also contribute to the dampening of increasing populations of "destructive" insects.

Snags and decadent green trees are used by bats for hibernation and day time roosting.

### Black Bear

Black bears are found in a variety of habitats including regenerating clearcuts with an abundance of non-coniferous, food producing species. Mature and second growth coniferous forest are used for escape cover and protection from weather extremes. (Trippensee 1948) Hollow snags or logs, decadent green trees, caves or crevices in rocks and cliffs are used for dens. (Jonkel and McTcowan 1971 and Ingles 1965) Although a carnivore, black bears feed largely on vegetable matter such as roots, fruits, nuts and grasses. They also eat insects, fish and small rodents. (Ingles 1965)

### Fisher, Marten, Mink and Weasles

These species are valuable fur-bearers and predators on forest wildlife such as hares, rabbits, mice, woodrats, pocket gophers, mountain beaver, quail and grouse. (Ingles 1965) Fishers are also known to prey upon porcupines. (Ingles 1965)

Mink and weasles are relatively common throughout the analysis area. The fisher is listed as rare by the State of Oregon. (OSU 1972) Only one recent fisher sighting has been reported in the district; that one in the Lorane Area, near Haight Creek by Jerry Mires, (1975) then employed as a summer biologist.

The fisher is a solitary animal, requiring heavy timber protection for rearing its young, and a territorial area of ten square miles. (Ingles 1965) The marten is arboreal, spending a large proportion of its time in the forest canopy while the primary habitat for mink and weasles is dense vegetation, rock outcrops, hollow logs and snags near water. (Ingles 1965)

Coyote, Foxes, Bobcat

These species are important predators on forest wildlife, such as hares, rabbits, ground squirrels, gophers, mice and woodrats. They therefore, contribute to a balanced forest ecology essential for rapid reforestation.

These species are generally adaptable and utilize a variety of habitats. Caves and crevices in rocks and cliffs, etc., are apparently favored for denning where available. (Ingles 1965) Hollow logs, snags and green trees are used in the absence of rocky habitats.

Mountain Lion

Mountain lions are an important ecological asset due to 1) the dampening of population increases of deer and rodents, 2) removal of prey individuals possessing harmful adaptive features and 3) dispersal of deer populations on the winter range, thereby reducing over use of range. Solitude is the primary habitat requirement of this species. (Hornocker 1970 and Hornocker, Seidensticker, Wiles and Messick 1973)

Northern Flying Squirrel

This species is an important prey of the Northern spotted owl. It is nocturnal, arboreal, and feeds heavily upon fungi and hair moss. Flying squirrels move through the forest by jumping from a tall tree and gliding to the base of another, climbing the tree and jumping again. The species is confined to timber of relatively large size. It nests in woodpecker holes or other tree cavities as well as in the branches of coniferous trees. (Ingles 1965)

Beaver

This species is highly prized by fur trappers. It is now an extremely common animal in many locations throughout the district, following a state restocking program in the late 1920's.

Roosevelt Elk

Clearcut areas, 40 acres or smaller, between 6 and 10 years after logging, provide prime elk forage. Escape cover should be available within 200 yards of the center of cutovers in two or more directions. Old growth forests are preferred habitats for protection from weather extremes. The very minimum, however, are stands in the 8" diameter class. (King) Dense vegetation at least 20' tall is useful escape cover if within 200 yards of foraging and browsing areas. Elk make repeated use of specific benches, natural openings, bottoms and ridgetops. Nearby water is essential for good elk habitat. Elk are easily disturbed by human activities and are susceptible to diseases and parasites of domestic livestock.

Clearcut areas that have been burned provide the best browse and forage for elk. The following table summarizes forage plants consumed by elk on the Millicoma Tree Farm; figures in percentage of forage consumed: (Oregon State Game Commission 1971)

| Species | Spring | Summer | Fall | Winter | Total of Annual Diet |
|---|---|---|---|---|---|
| Trailing Blackberry | 15.7 | 14.0 | 12.3 | 17.7 | 16.0 |
| Grasses, Sedges | 12.8 | 11.7 | 21.1 | 14.6 | 12.9 |
| False Dandelion | 8.0 | 10.7 | 10.1 | 8.8 | 8.5 |
| Vine Maple | 8.5 | 14.6 | 3.0 | 0 | 7.3 |
| Salmonberry | 8.6 | 4.3 | 1.8 | 2.8 | 7.0 |
| Red Huckleberry | 5.4 | 7.6 | 7.1 | 5.7 | 6.3 |
| Salal | 3.6 | 4.8 | 8.4 | 10.2 | 6.0 |
| Thimbleberry | 8.8 | 7.9 | 3.1 | .7 | 5.9 |
| Hemlock | 3.4 | 3.7 | 5.0 | 6.0 | 4.1 |
| Blackcap | 5.8 | 5.8 | 1.9 | 0 | 4.1 |
| Elderberry | 3.9 | 4.7 | 0 | .3 | 3.1 |
| Sword fern | 2.3 | 1.4 | 5.7 | 7.7 | 3.0 |
| Willows | 3.1 | 2.9 | 1.7 | .5 | 2.5 |
| Forbs | 1.7 | 0 | 0 | 4.4 | 2.3 |
| Firewood | 1.7 | 1.8 | 5.0 | 4.7 | 2.1 |
| Bracken fern | 2.5 | 1.9 | 1.7 | 1.4 | 2.1 |
| Oregon grape | .9 | .6 | 5.0 | 4.9 | 1.8 |
| Evergreen huckleberry | .9 | .4 | 0 | 3.8 | 1.7 |
| Whipplea | 1.2 | .3 | 7.0 | 2.3 | 1.4 |
| Red cedar | .8 | .4 | 0 | 2.6 | 1.3 |
| Douglas fir | .4 | .7 | .1 | .9 | .7 |

Elk (see Map 8) are common in the northwest portion of the analysis area. A small band also ranges through the Smith River valley into the analysis area in the vicinity of Elk and Panther Creeks in the Roseburg District. The Oxbow Burn area is rapidly developing into suitable elk habitat and will be populated by animals from the two areas mentioned above.

Several timbered tracts within the analysis area have been classified as "crucial" habitat as prescribed by BLM Manual 6610.3. Cover values provided by these tracts are believed necessary to sustain the existence and perpetuation of Roosevelt elk in their current (mapped) range. Past, and anticipated, timber harvest activities on both private and BLM land have weighed heavily in the classification of these areas.

Black-tailed Deer

Black-tailed deer require open areas that produce abundant forage and browse interspread in timber that provides cover for escape and protection from weather extremes. "Consecutive cuts, bordering one another, create large openings several hundred acres in size. This back to back placement in effect increases the size of the clearcut and produces suboptimum habitat for deer. For maximum utilization, the width of the cut should not exceed 1,200 to 1,500 feet or twice the distance deer are likely to move from the forest edge." (Oregon Wildlife Commission 1974)

Preferred winter and early spring foods consist of residual trailing blackberry leaves, red huckleberry twigs, salal leaves, grasses and forbs. Douglas fir is less palatable but constitutes an important food where deer populations approach or exceed the carrying capacity of the range. Throughout the district, winter populations are highest at lower elevations and on warmer south and west slopes. During late spring and early summer, the diet consists of a great variety of forage with few species being totally unacceptable. It is during this period that succulent growth on Douglas fir seedlings is realized in certain areas. During late summer and fall, Douglas fir is ignored as preferred foods include thimbleberry, salmonberry, willow, red huckleberry, red alder and trailing blackberry. (Oregon Wildlife Commission 1974)

Black-tailed deer are common throughout the analysis area.

## BIRDS

### Great Blue Heron

This bird's large size and conspicuous habitat of nesting in colonies in tall trees has drawn the attention of many interested persons. Great blue herons seem to require tall trees for nesting within a mile, preferably less, of major bodies of water such as rivers, lakes, or bays. There are no known nest colonies in the analysis area.

### Wood Duck

Over-hunting and destruction of its nesting habitat led to complete protection of this species in 1918. Populations have now increased to the extent that it is now hunted. The wood duck is the only Oregon pond duck that nests in trees. It uses cavities in old snags but has benefited greatly from erection of nest boxes. (Oregon State Game Commission)

### Red-tailed Hawk

Probably the most common and most often observed hawk in the forest environment. Because its prey consists primarily of small rodents, the "red-tailed" provides a dampening effect on increased populations of coniferous seed and seedling damaging rodents. Although commonly seen soaring over open areas, timbered habitats are used for nesting, roosting and perching when not hunting. Large (old growth) timber is preferred, although second growth will probably suffice if large enough to hold nests a minimum of 35' in the air. (Bent) Red-tails may be found throughout the analysis area.

### Bald Eagles

The Northern bald eagle is considered "threatened" by the State of Oregon.

The diet of the bald eagle varies according to locality and food availability, but fish is the staple food item. Dead and dying fish are eaten as readily as live ones. Eagles also consume carrion, including the remains of poultry and livestock. Live rodents and waterfowl are also taken.

Nest trees are usually the largest or the stoutest in the immediate surroundings, command an open view of the surrounding area, and provide a clear flight path to a close point on a beach or river. A large body of water will usually be within one-half to one mile distant. Nests are usually placed below the crown at a main branch so as to receive some cover from the part of the tree above the nest. Good perch trees in the vicinity of the nest also appears to be an important factor in nest site selection.

Bald eagles also seem to require an environment far from major disturbances for nest sites. There are no known nests in the analysis area.

Osprey

Osprey feed almost exclusively on fish and are able to take only those that swim at, or very near, the water surface.

Osprey forage by perching on rocky outcrops or snags which provide a view of a large expanse of water, or by flying over the water at altitudes of up to 300 feet.

Ospreys are fairly flexible with regard to nest sites and will nest on artificial structures located near suitable feeding areas. Snags or trees with dead crowns are usually located within a few hundred feet of nest trees. These are utilized by adults as roost and feeding trees and by fledglings as perches while learning to fly. (Jackman & Scott, 1975) There are no known Osprey nest sites in the analysis area.

Ruffed Grouse

The diet of ruffed grouse is highly variable depending upon the availability of food and includes seeds, berries, vegetation and insects. Specifically, important items include strawberries, raspberries, cherries, blueberries, serviceberry, rose hips, sedges, dogwood berries, snowberry, mushroom, fern tips, and buds of alder, willow, maple and conifers.

Ruffed grouse are generally associated with deciduous trees and brush thickets, especially along the forest edge adjacent to openings. Conifers are used for roosting and protection from weather extremes.

Spotted Owl

This species, currently listed as "threatened" by the State of Oregon, is extremely sedentary and restricted in its habitat preference.

Preliminary results of studies by Eric Forsman indicate that important food preferences of spotted owls include flying squirrels, red tree mice, deer mice, woodrats, red-backed moles, Mazama pocket gopher, snowshoe hare, and small birds. A great deal of the owl's foraging occurs in the forest canopy. (Jackman & Scott, 1975)

Old growth Douglas fir forests are believed essential to the survival of this species. These forests, with large trees and

R7W R6W R5W R4W

T18S

T19S

T20S

T21S

Hadleyville

Alma

Gipter

Wolf Point

Stony Pt.

High Pt.

Bailey Hill

Murray Hill

MILES
0 1 2 3

NATIONAL RESOURCE LANDS

ANALYSIS AREA BOUNDARY

# SIUSLAW OIL AND GAS LEASING ENVIRONMENTAL ANALYSIS RECORD

CURRENT, MAJOR ELK RANGE.

DEVELOPING ELK RANGE

OXBOW BURN.

ESTIMATED NORTHERN LIMIT OF SMITH RIVER ELK.

TIMBERED AREA - CRUCIAL ELK HABITAT.

TIMBERED AREA - CRUCIAL SPOTTED OWL HABITAT.

WILDLIFE
MAP 8

dense understories apparently provide the total needs of the species, including nesting sites, a source of food and protection from predators and weather extremes. Foraging is known to occur in young growth stands, however.

Spotted owls are extremely territorial and utilize an area of one to two square miles.

Several tract of old-growth timber within the analysis area have been classified as "crucial" habitat (see Map 8) as prescribed by BLM Manual 6610.3. The wide range of habitat values provided by these tracts are believed necessary to sustain the existence and perpetuation of Northern spotted owls in the Lorane Area.

Pileated Woodpecker

A large percentage of the pileated's diet consists of carpenter ants that penetrate upwards from the base of a tree. Beetle larvae excavated from rotting wood also constitute an important part of its diet.

Pileated woodpeckers tend to nest near water. They require a large tree in which to excavate a cavity for nesting and roosting. Foraging habitats require the habitat contain fallen dead wood in advanced state of decay.

The pileated may be the sole provider of holes for larger non-excavating hole nesters, such as hooded mergansers, common mergansers, wood duck and various small mammals. (Jackman & Scott 1975)

Purple Martin

Purple martin populations have apparently never been high in western Oregon in comparison with the eastern United States. This small population has declined in recent years, partially because of a loss of nest sites.

Purple martins nest in natural or man-made cavities near ponds, lakes, bays and rivers. They forage almost exclusively on the wing, taking whatever flying insects are available. (Jackman & Scott 1975)

Western Bluebird

Western bluebird populations have also declined in western Oregon in recent years due partially to a loss of nesting sites.

Western bluebirds nest in natural and man-made cavities located in openings or along the forest edge. When not in flight, western bluebirds are most often seen perched in the top of dead or dead-topped trees. (Jackman & Scott 1975)

B. Aquatic

The general distribution of cold water salmonid species including chinook salmon, coho salmon, steelhead, and cutthroat trout is shown on Map 9. All streams used by salmon and steelhead or valuable for fishing are considered crucial habitat within the analysis area if populations are to be maintained at present levels.

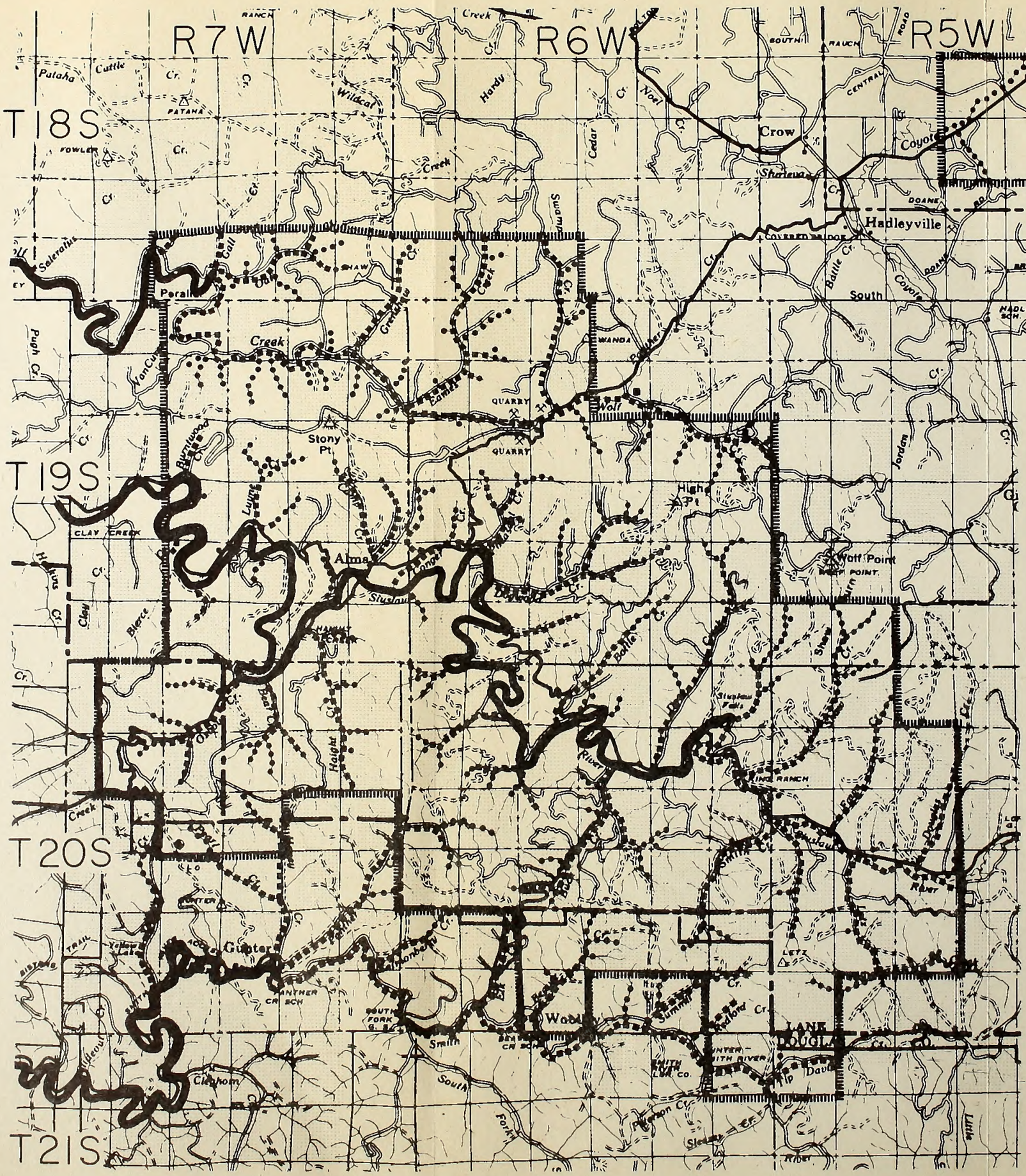
Additional species present in the area are included in Table 5, which contains data from the Oregon Department of Fish and Wildlife. The Department also provided information in Table 6 relative to periods when salmon, steelhead, and trout are present in streams. Table 7 indicates the general quality of fish habitat and primary types of fish use by salmonids in stream drainages involved.

There are no known threatened or endangered aquatic species in the area.

TABLE 5

FISH SPECIES

| Species | Abundance | Distribution |
|---|---|---|
| Chinook salmon | Moderate | Smith River, Siuslaw River & Wolf Creek |
| Coho salmon | High | Above streams and tributaries |
| Steelhead | High | Above streams and tributaries |
| Cutthroat trout | High | All drainages |
| Pacific lamprey | High | All drainages |
| Brook lamprey | Moderate | All drainages |
| Cottid | High | All drainages |
| Dace | High | All drainages |
| Shiner | High | All drainages at lower elevations |
| Squawfish | High | Major drainages at lower elevations |
| Sucker | High | Major drainages at lower elevations |




MILES
0 2 3

NATIONAL RESOURCE LANDS

ANALYSIS AREA BOUNDARY

SIUSLAW OIL AND GAS LEASING
ENVIRONMENTAL ANALYSIS RECORD

* CHINOOK, COHO, STEELHEAD, & CUTTHROAT.

* COHO, STEELHEAD, & CUTTHROAT.

CUTTHROAT TROUT.

* CRUCIAL AREAS.

FISH HABITAT
MAP 9

PERIODS WHEN ADULT SALMONIDS ARE PRESENT OR SPAWNING

| Species | July | Aug. | Sept. | Oct. | Nov. | Dec. | Jan. | Feb. | Mar. | Apr. | May | June |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Spring chinook* | ..... | ..... | ....---- | ----xxxx | xxxxxxxxx | xxxxxxxxxx | xxxxx | | | ... | ..... | ..... |
| Fall chinook | | | ..... | ....--- | ---------- | ---xxx | xxxxxxxx | xxxxxxxxx | xxxx | | | |
| Coho salmon* | | | ..... | ..... | ... | ---------- | ---xxx | xxxxxxxx | xxxxxxxxx | xxx | | |
| Cutthroat trout* | ..... | ..... | ..... | ..... | ..... | ..... | ---------- | ---------- | ---------- | xxxxxxx | xxxxxxxxx | |
| Winter steelhead* | xxx | | | ..... | ..... | ..... | ..... | ---------- | ---------- | ---------- | xxxxxxxxx | |

* Juveniles rear one or more years in fresh water prior to seaward migration
..... Adults present in streams.
---------- Periods of heaviest spawning.
xxxxxxxxxx Periods after spawning when eggs and fry are still in the gravel.

TABLE 6

TABLE 7

FISH HABITAT QUALITY AND TYPES OF FISH USE

| Stream | Quality | Migration | Spawning | Rearing |
|---|---|---|---|---|
| Siuslaw River | Excellent | X | X | |
| Siuslaw Tributaries | Fair to Good | | X | X |
| Wolf Creek | Good to Excellent | X | X | X |
| Wolf Creek Tributaries | Fair to Good | | X | X |
| Smith River | Generally Excellent | X | X | X |
| Smith River Tributaries | Fair to Good | | X | X |
| Coyote Creek Drainage | Fair | | X | X |

The following briefly discusses aquatic species and fishing opportunities relative to streams within the analysis area.

Chinook salmon migrate to the ocean as fry or fingerlings and return to spawn in approximately three to five years. Chinook migrations in the oil and gas lease area of influence depend on spawning gravel in mainstems of Smith River, Siuslaw River and Wolf Creek, since they do not normally spawn in smaller tribuatires.

Most of these salmon are fall chinook, but a remnant run of spring chinook also exists in the Siuslaw River. Summer water temperatures in the Siuslaw River and Wolf Creek are excessive, resulting in inadequate habitat for substantial numbers of spring chinook since these fish rear in the stream throughout the summer.

Small numbers of chinook have migrated upstream from Siuslaw Falls following installation of a fish ladder by the State of Oregon. However, little spawning gravel is available in the Siuslaw River above the falls because of silt accumulations.

Most chinook in Smith River drainage enter the North Fork of Smith River downstream from the oil and gas lease area. Limited numbers of chinook migrate upstream from Smith River Falls where a fish ladder also has recently been constructed.

Coho Salmon return from the ocean in their third or fourth year. These fish use Smith River, Siuslaw River, and Wolf Creek especially for migration, while many medium size and small tributaries provide spawning habitat. Rearing also occurs in these streams except where water temperatures are too high.

Steelhead are rainbow trout which migrate to the ocean. Use of streams by steelhead is similar to coho although some variations occur. Examples include less frequent use of many creeks, common use of large streams for spawning, and relatively low populations in the Upper Siuslaw drainage. Steelhead return to fresh water from the ocean at about four years. A small proportion of steelhead migrate back to the ocean and may return to spawn the second time.

Cutthroat trout have two life styles. Some migrate to the ocean, while others remain in fresh water. Sea-run cutthroat occur in Smith River, Siuslaw River, and Wolf Creek drainages. Cutthroat trout in Coyote Creek drainage may migrate downstream to Fern Ridge Reservoir. Essentially all creeks containing water during summer are used by cutthroat for spawning and/or rearing. These streams generally are considered class I habitat, based on the State of Oregon stream classification system.

Pacific lampreys prey on other fish in the ocean most of their lives and return to fresh water to spawn. Brook lampreys are resident species which stay in the streams.

Cottids are found throughout the area and are considered predators on young salmonids. Dace and shiners occur especially in relatively warm streams where they compete with other fish for food. They also may be used by salmonid species as food.

Squawfish and suckers are present in larger streams, although none are known to inhabit Smith River within the oil and gas lease area. Squawfish prey on other species, and suckers compete with salmonids for food.

Other Aquatic Animals

(1) Crayfish occur throughout all stream drainages. These crustaceons are important as fish food in addition to providing human food and recreation.

(2) Aquatic insects valuable as food for fish include primarily mayflies, stoneflies, and caddisflies. These insects are found in essentially all streams with high water quality.

Fishing. Streams in the Siuslaw Oil and Gas Lease area of influence are very valuable for the production of many salmon that are caught by commerical and sport fishermen. Chinook and coho salmon which are produced in the vicinity are caught mainly in the ocean and tidewater during summer and fall.

Siuslaw and Smith Rivers are important fishing streams for steelhead during the winter, except when turbidities are too high. These rivers and Wolf Creek also are valuable for cutthroat fishing. Many sea-run cutthroat produced in the area are caught downstream and in tidewater.

The following habitat requirements of salmonides were provided by the Oregon Department of Fish and Wildlife.

Spawning. Anadromous fish require gravel for spawning. For salmon and steelhead gravel should range between one-quarter inch and six inches in diameter with extremes in sizes being least desirable. Chinook salmon normally select slightly larger gravel than do coho or steelhead, while trout choose the smaller gravels. Gravel should be relatively free of silt and must not be seriously compacted. Excessive silt in the gravel creates adverse conditions for eggs and fry by causing low intergravel flows at reduced velocities. This results in low supplies of available dissolved oxygen and inhibits the escapement of fry from the gravel. Adequate depth of gravel is necessary for construction of a nest, or redd, by the female fish. Depending on species, redd depths may vary from approximately 6 to 15 inches.

Suitable water temperatures for spawning range from about 42° to 53° F. Temperatures outside these limits can cause excessive loss of eggs. Eggs from salmon and steelhead hatch in about two months, and fry emerge from the gravel about two weeks later. Incubation time is controlled by prevailing water temperature, with less time required at warmer temperatures.
The minimum dissolved oxygen requirement for egg and fry survival is higher (near 8 parts per million) than for adult fish (near 5 parts per million). The greater oxygen demand of eggs and fry is satisfied by good permeability and rate of intragravel flow, both of which are influenced by gravel size, stream gradient and amount of sedimentation.

Proper surface water velocities and depth are necessary to attract spawning fish. Minimum velocity for most salmonids is about one foot per second. Depths required vary with species and individual fish size.

Rearing. The most critical time in the freshwater life of young anadromous fish after hatching is the summer low flow interval. This is generally referred to as the period of "rearing." Steelhead and cutthroat generally spend two years and spring chinook one year in fresh water before migrating to the ocean. Fall chinook normally migrate from their parent stream within three months after hatching.

The size and success of an anadromous fish population is largely dependent on certain conditions within the stream during the rearing period. These conditions fall into three main categories:

(1) Food. Young salmonids' food during stream residence consists primarily of immature aquatic insects. Production of these organisms is confined almost entirely to riffle areas. The best producing riffles are those composed of unsilted gravel or rubble and well aerated by clean, flowing water.

(2) Shelter. Shelter is any location a fish will remain or return to when frightened or disturbed. Such places may be found within riffles but are more often associated with deeper pool areas. Shelter is necessary for resting and as a refuge where fish can escape predators.

(3) Suitable Medium. Suitable medium refers primarily to water quality requirements. Good rearing water is high in dissolved oxygen (above 5ppm), low in turbidity, not greatly acid or alkaline and has temperatures not exceeding 65°F for extended summer intervals.

High water temperatures contribute to fish mortalities by exceeding the tolerances of salmonids. As temperature increases, water losses its capacity to hold dissolved oxygen. Simultaneously, the metabolic rate and resultant oxygen demand of cold-blooded animals rises. This causes a condition of greater need with rising temperatures.

Turbid waters generally cause greater damage to fish habitat than to fish themselves, mainly from the siltation of food-producing and spawning areas. Heavier silt loads can also drive fish from a stream, impair their health, and result in actual mortalities.

Adequate summer flows play a vital part in meeting basic food, shelter, and suitable medium requirements. Without an adequate flow, any or all of the necessary conditions may not be satisfied; the elimination of but one factor can be sufficient to severely limit or even destroy a salmonid population.

Passage. By definition, anadromous fish migrate between the ocean and fresh water. To do so they must have enough flow for passage. As upstream migrants, adult salmon, steelhead and trout require a portion of the stream cross-section to possess sufficient water depth so passage will not be impeded. Juvenile anadromous fish need adequate water volume for interstream movement during their rearing period and later to support an uninterrupted seaward migration.

## HUMAN VALUES

### A. Landscape Character

The majority of the analysis area is located within the Coast Range physiographic province. The isolated tracts in Township 18 South, Ranges 4 and 5 West are within the Willamette Valley physiographic province. For the purpose of descriptive analysis the study area is further broken into the following units: 1. Coast Range-General, 2. Oxbow Burn, 3. Siuslaw River and Wolf Creek, 4. Upper Smith River Valley, and 5. Willamette Valley Foothills.

Coast Range-General. The natural landscape of the Coast Range is dominated by topographic form and vegetative texture. The land form is mountainous with a deeply dissected dendritic drainage pattern characteristic of a geomorphically "early mature" landform. The main streams - Siuslaw River, Wolf Creek and Smith River have cut deeply into the land mass. These major streams flow through narrow but generally leveled valley bottoms where the streams themselves tend to meander within tightly constrained limits. Side drainages are in V shaped valleys and have steeper gradients with extremely steep headwalls. The mountains tend to terminate in slightly rounded narrow ridges. There are few dominant peaks in the coast range. Most of the ridge tops terminate at a level between 1400 and 2000 feet above sea level. The Siuslaw River Valley is at the 500 foot level, so the net relief is on the order of 900 to 1500 feet.

The naturally rugged form of the mountains is softened by the dominant green color of the vegetation and the texture of the conifer forest. The vegetative cover has been modified so extensively by timber harvest that the natural vegetative pattern of a dense canopy of old growth conifers has been largely supplanted by the patchwork design of clearcut logged areas in various stages of revegetation, interspersed with relic stands of remaining old growth conifers. The evidence of logging is so common and so persistent over time that it must be considered now as a relatively permanent characteristic of the landscape.

The shape and size of individual clearcut harvested units varies from less than 20 acres to over 600 acres though the average size individual unit tends to be around 30 to 100 acres. The interspersed public and private ownership pattern on a rectangular grid base tends to result in a timber harvest pattern that produces vegetative lines (cutting lines) and forms (shape of clearcuts) in a rectilinear pattern that disregards natural features.

The Coast Range generally features "enclosed landscapes" such as narrow valley bottoms bordered by steep hills and ridges, road corridors bordered by trees and hills, or stream channels enclosed by adjacent trees and brush. Views are limited from the most used vantage points and travel routes. The visitor seldom sees beyond the foreground distance (3 miles or less).

Oxbow Burn. The Oxbow fire, fourth largest burn in Oregon's history, covered a total area of nearly 43,000 acres, of which a little more than 5,000 acres are within the Siuslaw analysis area. The fire occured in August of 1966. Being the largest recent burn in Oregon's history the area is a visual curiosity and commands a modest sightseer interest.

The topographic character of the burn area is the same as the Coast Range generally. However, the burn is generally denuded of trees taller than 6 feet. The visually strong elements are the form and lines of barren ridges. The deeply incised canyons and numerous draws and sharp ridges accentuate the vertical lines. Horizontal lines such as road cuts in hillsides are easily seen and highly discordant. Sharp ridges denuded of trees produce a sharply discerned hard skyline. Any activity on the ridgetops is especially noticeable. Colors for the most part are muted tones of brown and green, except in summer when there are locally significant patches of fireweed blooming or in the fall when the deciduous brush turns red and yellow.

Siuslaw River and Wolf Creek. The Siuslaw River and its major tributary Wolf Creek constitute narrow visual corridors in the bottom of similarly narrow valleys. The river and the creek are seldom seen from the valley slopes and only occasionally glimpsed from the roads traversing the valley bottoms. They are considered here as separate visual units because these water bodies and adjacent vegetation do create corridors of visual environment that are different than the environment seen in the Coast Range - General, where water is not a major element of the landscape.

These corridors tend to have tightly "enclosed landscapes" in many cases fully or nearly "canopied" by stream bank vegetation. The streams are meandering which limits the visual axis nature of the feature. Visibility along the stream bottom lands is generally limited to a few hundred feet.

The stream and streambanks are strong horizontal lines, which are flanked by strong vertical lines in the form of tree trunks and occassional steep hillside banks. Individual bushes, trees and tree boughs are the dominant texture. The water texture of the slow meandering Siuslaw is occassionally broken by rocks and short riffles. The Siuslaw is turbid to partially turbid in winter, turning to slightly turbid in summer. Wolf Creek is a more clear, faster moving and rougher water stream than is the Siuslaw. Both stream banks are dominated by the dark greens of conifer trees and lighter greens of hardwoods and brush. In winter the streambanks trend toward the grays and browns of bare deciduous brush and hardwoods.

Upper Smith River Valley. Only a very small portion of this valley falls within the analysis area, though the valley itself is considered to be sufficiently different from other described units as to constitute a separate visual unit. The valley was rated Class B scenery primarily on the strength of a variety of landforms, line, color, and textures exhibited. Water is not a major ingredient of the landscape. Smith River is a small creek in the upper portion of the valley.

The dominant features are the tree covered hillsides which present a relatively unbroken carpet of green and the valley meadows which contrast in color and texture with the trees. The general absence of discordant intrusions is apparent. It appears that once bare logged over hillsides have had a chance to heal over and regenerate another crop of trees.

Along the valley floor the road traveler is presented with a constant changing scene from narrow steep hillside valley to open meadow to old growth forest stand to young growth timber stand to open meadow again.

Willamette Valley Foothills. The Willamette Valley Foothills are often "enclosed landscapes" but of a more open nature than those of the Coast Range. Viewing distances are longer. The enclosing relief of low rounded foothills is less constricting. The contrasting forms of open meadows, cultivated fields and woodland fringes provide a great variety in form, line, texture and color, though it is repetitious and very common within the region.

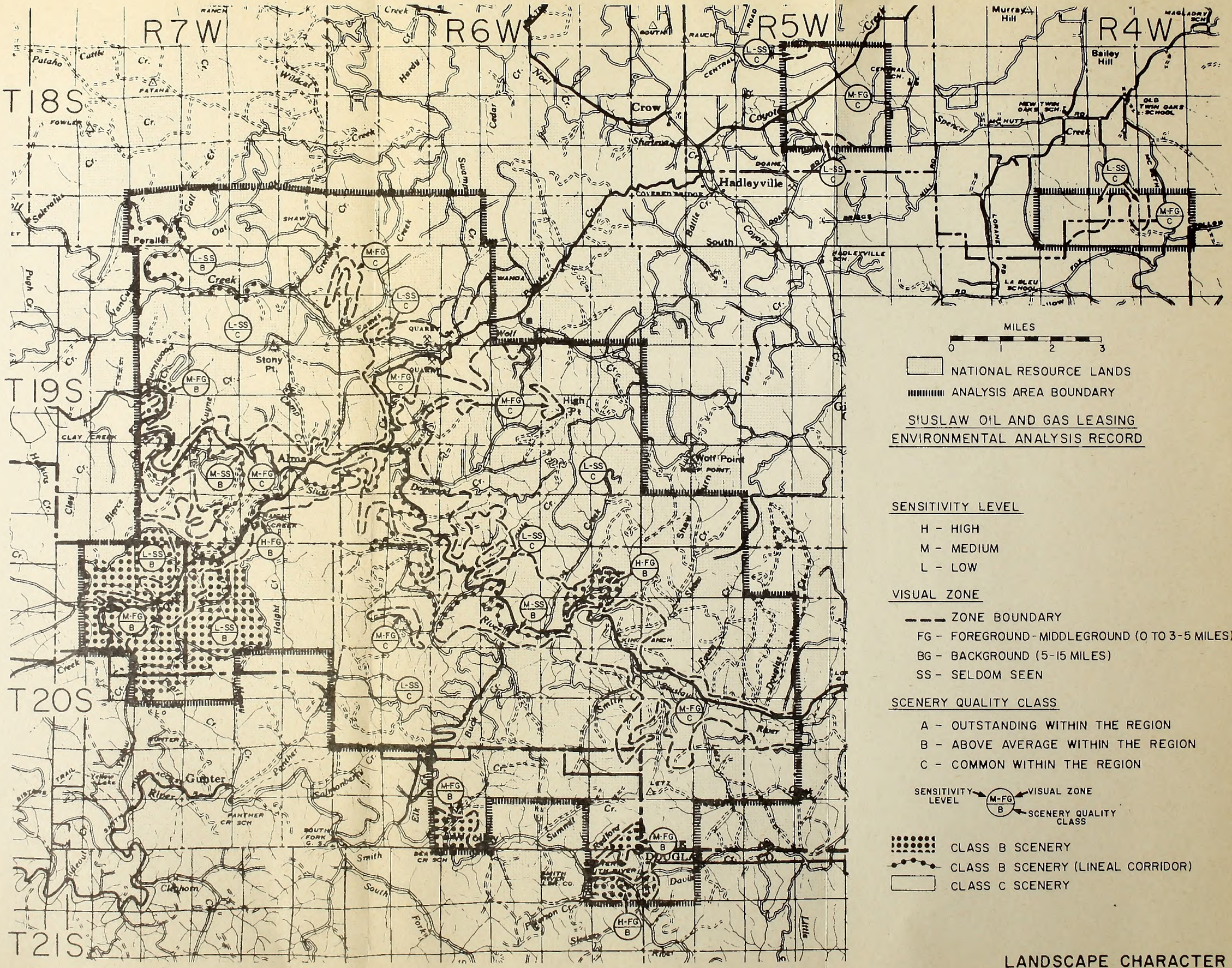
Openings in the woodland canopy and evidence of soil disturbance (color and texture changes) are not overly conspicuous because they are common features within this landscape. Structures in the form of barns, silos and houses are also common to the landscape.

The quality and sensitivity level of the visual environment of the analysis area have been inventoried according to principles contained in BLM Manual 6310 Visual Resources Inventory and Evaluation. Map 10 depicts the results of that inventory.

The scenery quality is a judgment based upon the composite visual effect of the following factors: land form, color, water, vegetation, relative uniqueness, and intrusions. It is rated as: A scenery - outstanding quality; B scenery - above average in visual interest quality; C scenery - common scenery with little special visual interest.

The visual resource use sensitivity level is a conclusion derived from an assessment of factors including: the visitor use volume, the visitor use activity association, community attitudes, non BLM uses of land, and other public agency interests. Sensitivity levels are rated high, medium or low.

Another factor influencing visual use sensitivity is the proximity of the visual scene to the viewer. Visual zones as seen from high and medium sensitivity areas, viewpoints and travel routes are delineated on the map. Visual zone designations are: Foreground - Middleground, the area that can be seen from each travel route or sensitive area for a distance of 3 to 5 miles, or the point where the texture and form of individual plants is no longer apparent; Background, the remaining area which can be seen from sensitive areas and travel routes; and Seldom Seen, the area generally hidden from view from the high and medium sensitivity areas.




SIUSLAW OIL AND GAS LEASING
ENVIRONMENTAL ANALYSIS RECORD

SENSITIVITY LEVEL

- H - HIGH
- M - MEDIUM
- L - LOW

VISUAL ZONE

- ZONE BOUNDARY
- FG - FOREGROUND-MIDDLEGROUND (0 TO 3-5 MILES)
- BG - BACKGROUND (5-15 MILES)
- SS - SELDOM SEEN

SCENERY QUALITY CLASS

- A - OUTSTANDING WITHIN THE REGION
- B - ABOVE AVERAGE WITHIN THE REGION
- C - COMMON WITHIN THE REGION

SENSITIVITY LEVEL — M-FG B — VISUAL ZONE
SCENERY QUALITY CLASS

- CLASS B SCENERY
- CLASS B SCENERY (LINEAL CORRIDOR)
- CLASS C SCENERY

LANDSCAPE CHARACTER
MAP 10

B. Socio-cultural Interests

Historic Values Correspondence with the office of the State Historic Preservation Officer indicates that there are no sites within the analysis area which are listed on the National Register of Historic Places or the Statewide Inventory of Historic Sites and Buildings. The potential for the existence of as yet undiscovered historic values within the analysis area is minimal.

The historic Applegate Trail established in 1846, which served as an overland route between Portland and the California gold fields, passes a few miles east of the analysis area. Immigrants were settling along this trail near the headwaters of the Siuslaw River by 1850, just three years after the initial settlement of the Eugene-Pleasant Hill area. The Applegate Trail followed the route of an Indian trail which was used by Hudson Bay Company parties as early as 1830. Despite the presence of this trail and the early settlement of the headwaters area of the Siuslaw River there is little evidence in the literature to suggest settlement in the analysis area prior to the 1880's. From that date to the present scattered farmsteads have occupied the few favorable locations along the river, but population density has never been high in the area.

Archaeological Values The Willamette Valley from Oregon City to its southern end was inhabited historically by Calapuyan speaking peoples. Popular literature has erroneously referred to these peoples as the Calapuya tribe. The Calapuya were not organized as a tribe or series of tribes. Instead, at least ten bands each speaking a slightly different dialect were associated with distinct territories within the valley. Political organization within these bands was not strongly developed and leadership was vested on the basis of individual qualifications.

Casual recovery of characteristic projectile point types indicates that the Willamette Valley was first occupied around 10,000 years ago. Widespread occupation of the valley floor by 4,000 years ago is well documented. The evidence indicates that aboriginal life styles depended upon the exploitation of seasonally available food resources and serial occupation of four environmental zones: riparian, main valley floor, narrow valley plain, and valley edge upland.

A search of the Oregon Archaeological Survey files revealed one recorded prehistoric site within the boundaries of the analysis area. This site is not located on National Resource Land. This single recorded site is not an accurate reflection of the archaeological potential of the area, rather it is an artifact of the research programs completed by the professional community to date. A number of aboriginal artifacts on display at the Lane County Pioneer Museum are from the Siuslaw River valley. Specific

provenience data for these items is lacking making it impossible to determine the percentage, if any, recovered from the area of this analysis.

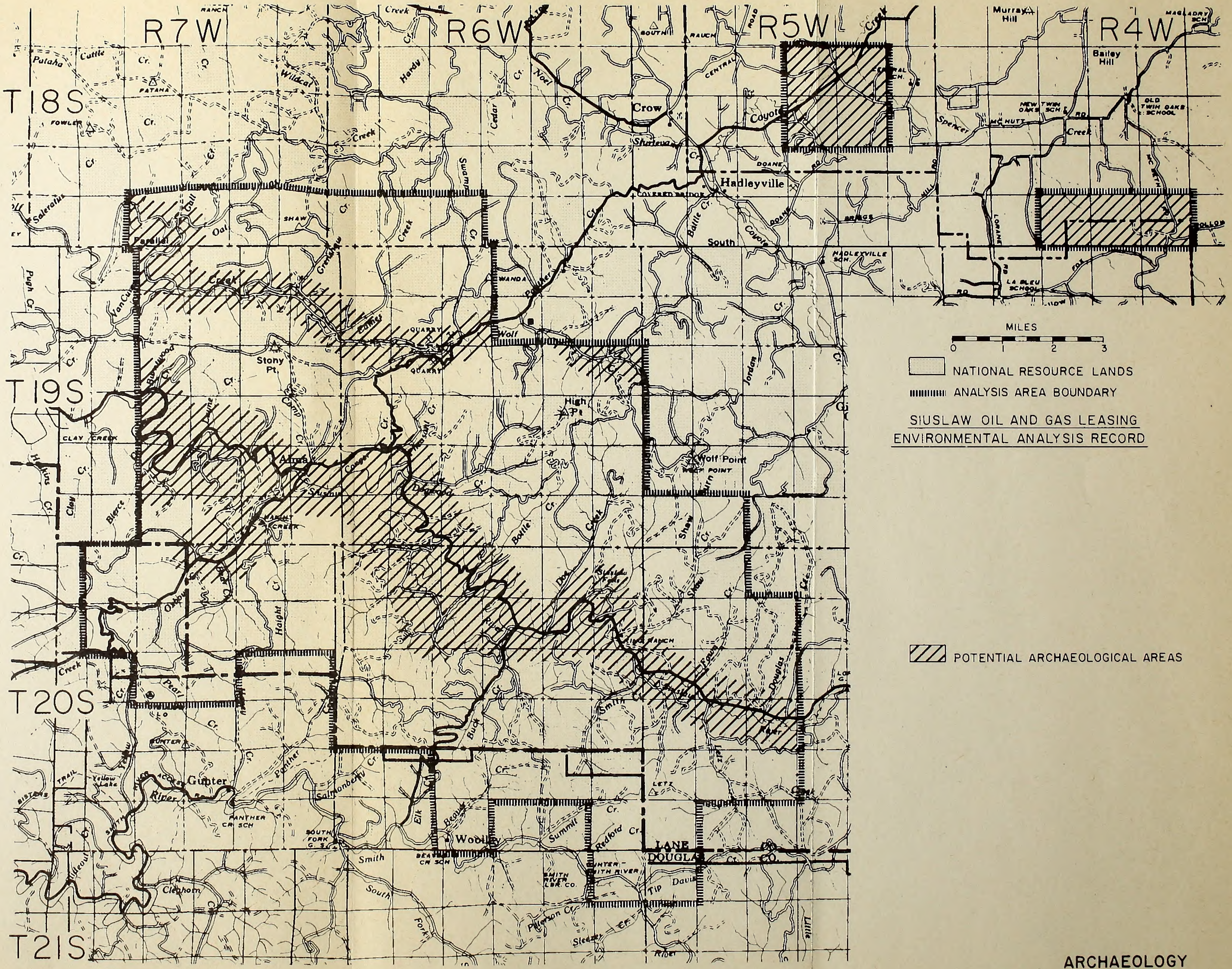
Since much of the analysis area is mountainous terrain with a dense forest cover, the archaeological potential is minimal. However, two larger streams, the Siuslaw River and Wolf Creek, transect the area and their valleys (See Map 11) have potentially high archaeological values. The valley of the Siuslaw River affords a relatively level route from the southern Willamette Valley to the coast. In addition, both streams have seasonal runs of anadromous fish, which would have been an attraction for aboriginal occupants.

Paleontological Values No known sites of paleontological value lie within the analysis area.

Social Welfare Most of the analysis area is included in Census Tract 8 of Lane County. It is one of the less densely populated portions of the county, with an estimated population base of 50. The labor force is 30% of the base population or approximately 15 individuals. Slightly over one-half of the labor force falls within the occupational grouping including craftsmen, transport and other operatives, and non-farm laborers. This segment of the labor force is, by and large, associated with the forest products industry.

Local Zoning Historically, the vast majority of rural lands have not been subject to any zoning restrictions and little control was afforded over development generally. Though such is still the case, there is a growing recognition of the need for land use regulations even in the more remote rural areas. For the past several years Lane County, which contains about 95% of the analysis area, has been deeply committed to comprehensive land use planning. The county has been divided into 12 planning units or subareas -- the divisions are based primarily on natural features and existing land use patterns.

Though the subarea planning process is on going, some areas are complete and adopted. The Long Tom-Fern Ridge plan is one of those adopted and the zoning process has begun. The plan includes that portion of the analysis area in T. 18 S., R. 5 W., and the preliminary zoning proposes designation as a Farm Forestry District (F-F-20). The F-F 20 designation also appears likely for the adjacent portion of the analysis area in T. 18 S., R. 4 W. even though it is not yet within the boundaries of an adopted county plan.




ARCHAEOLOGY
MAP 11

The F-F 20 Zone is intended to provide farming, grazing or timber production areas as free as possible from urban conflicts and other incompatible uses. It permits, on minimum lot size of 20 acres, general farming, grazing, growing and harvesting of forest products and single-family dwellings.(1)

The remainder of the analysis area is not in an adopted county subarea plan, and thus zoning is lacking. However, it is likely that the vast majority of the area will be zoned as a Forest Management District (FM).

The FM Zone is intended to preserve and protect lands for continued timber production, harvesting and related uses and to protect watersheds, wildlife habitats and other such uses associated with the forest. It generally permits, on minimum lot size of 40 acres, growing and harvesting of forest crops, general farming, grazing and single family or two-family dwellings.(1)

(1) Summarized from Lane County Zoning Ordinances; for specifics refer to Lane Code, Chapter 10, zoning.

## III. ANALYSIS OF PROPOSED ACTION

The following section describes the anticipated environmental effects of oil and gas field operations within the analysis area and recommends specific measures to lessen or preclude such impacts. To make this analysis, the following constraints and conditions were assumed:

All lessee's operations will be in conformance with applicable federal and state laws and regulations and standard lease stipulations as detailed in Section I and summarized on page I-18. The proposed action as it is controlled by such laws, regulations and stated operating procedures is what is being analyzed.

Additional, site specific, environmental assessments are a prerequisite to all surface exploration and/or development. The purpose of such subsequent analyses is to identify the environmental impacts of the proposed surface disturbing operations and to recommend appropriate mitigating measures to be included in the operations permit.

Road construction associated solely with oil and gas exploration will not be extensive. The existing forest road system is highly developed and designed for loads associated with exploration equipment. Additional road construction would be quite costly and possible locations are physically limited by topography.

A moderate oil and/or gas discovery is the maximum, reasonable level of development; any production will be transported to existing refineries for processing and distribution. This is based upon the history of oil and gas exploration in Western Oregon. More than 100 wells, ranging in depth from less than 2,000 feet to over 10,000 feet, have been drilled with no commercial discovery. While such history is not conclusive, it appears reasonable to assume that any future commercial discoveries will be small to moderate in size not justifying the installation of refineries.

In addition to these assumptions, the following analysis must also consider the possible type of impacts associated with the unpredictable -- accidents and errors in judgement, eg. oil spills, fires and well blowouts. Since they are unpredictable happenings, the size or degree of the impact is debatable. A view of recent exploration and development history may help bring some perspective to such a debate.

In fiscal year 1975 (July 1, 1974 - June 30, 1975), according to the USGS, fires and well blowouts occurred on 20 of the 10,092 on shore, producing, federal leases as follows:

| Fires | | Blowouts | |
|---|---|---|---|
| Wyoming | -7 | Wyoming | - 2 |
| Oklamhoma | - 2 | New Mexico | - 4 |
| Mississipii | - 1 | Colorado | - 2 |
| | 10 | Utah | - 1 |
| | | California | - 1 |
| | | | 10 |

The following table is a compilation of crude oil spills reported to the Environmental Protection Agency in five western states during 1972. The figures represent only oil spills attributed to field operations and do not include the transportation or the refining of crude oil. Of the total spills, 40 percent resulted from flowline corrosion or freezing. The remaining spills were caused by human error, mechanical failure, natural causes, poor maintenance, or in a few cases, vandalism. The statistics relate to spills on all ownerships -- private and State lands as well as Federal.

## Crude Oil Spills During Oil and Gas Development and Production Activities in Five Western States in 1972

| State | Total Reported | Total Barrels Spilled[1] | Average-Number of Barrels per Spill | Wells in Production[2] | Number of Spills per 100 Wells in Production |
|---|---|---|---|---|---|
| Colorado | 37 | 896 | 24 | 2,700 | 1.4 |
| Montana | 27 | 1,960 | 73 | 4,210 | 0.6 |
| N. Dakota | 19 | 813 | 42 | 1,490 | 1.3 |
| Wyoming | 74 | 9,676 | 131 | 9,300 | 0.8 |
| Utah | 16 | 1,434 | 90 | 900 | 1.8 |

(1) 646 bbls will cover one acre to a depth of 1 inch (646 bbl = 1 acre-inch)

(2) 1971 figures.

Source: Environmental Protection Agency, Region 8, Denver, Colorado

## ANTICIPATED IMPACTS

### A. Nonliving Components (Land, Water, Air)

Soil erosion and slope failures will increase with the construction of access roads, trails, drill pads, tank batteries, pipelines and other field facilities. The increase will result from the removal of protective vegetation, forest floor litter and humus layers, soil compaction, alteration of natural drainage systems and undercutting and overloading of natural slopes. Surface disturbing activities are especially critical within the analysis area on approximately 47,000 acres which have a high erosion hazard and on about 39,000 acres which have a high landslide probability. These critical areas are approximately shown on Map 6.

Subsidence of the ground surface above an oil and gas reservoir could result from the withdrawal of large volumes of fluids from poorly consolidated formations charged at greater than hydrostatic pressures. Such subsidence would reach a maximum rate during the production phase.

Seismicity may be affected by both the withdrawal of oil and gas and by the reinjection of waste fluids. The withdrawal of petroleum fluids has the effect of reducing formation pressures and may have the effect of decreasing the number and increasing the severity of local earthquakes. Reinjection of waste fluids, particularly along a fault zone, may result in increased fluid pressures at depth which could increase the frequency but decrease the severity, of local earthquakes.

Geologic hazards triggered by natural forces could damage oil and gas field facilities and cause oil spills, mud pit breaches, failures of road fills and other environmental problems during all phases of operations. Landslides could impact field operations if roads, well sites, or other facilities were located on or below unstable slopes.

Land will be temporarily and/or permanently removed from timber production. The amount will vary directly with the degree of oil and gas operations and could become significant if a field is discovered and developed.

Water quality could be adversely effected by the location of drill pads, tank batteries, pipelines and other field facilities within the flood plain of streams. Oil and other contaminants from blow outs and spills or from dikes and pipelines ruptured by highwater could be released directly into surface waters.

Dust from road construction and road use during drier seasons will have a localized adverse effect on air quality.

Smoke from slash fires associated with clearing operations could cause a temporary degradation of air quality.

Accidents (e.g. blow outs, fires, oil spills and dike breaches) or vandalism could increase erosion through destruction of vegetation, con-

taminate surface waters, sterilize soils and temporarily degrade air quality by the discharge of odorous and toxic natural gases. Oil fires, which may burn for days or weeks before they can be extinguished, would emit smoke and the products of hydrocarbon combustion into the atmosphere.

Oil and Gas facility construction within the boundaries of an identified potential recreation site could be detrimental to the site's future recreation development, especially if many existing trees were cut. The potential recreation sites are shown on Map 7.

Any surface use of an existing recreation site (see Map 7), or its adjacent buffer area, for oil and gas exploration or development activities will substantially detract from the recreation value of the site.

Information gathered during the first three stages of oil and gas operations may further the knowledge of the stratigraphy, structure and geologic history of the region and may aid future evaluations of mineral and fuel potentials.

Additional road construction associated with exploration and development could also be used for timber management and recreation access.

B. Living Components (Animals, Vegetation)

Increased stream sediment loads could result from erosion associated with the construction of access roads, trails, drill pads, tank batteries, pipelines and other field facilities. Sediment in suspension can directly kill fish by damaging their gills if concentrations are high and exposure prolonged. Sediment also blocks the transmission of light, reducing algae and vascular plant production and impairing the ability of fish to feed. When sediment covers gravel spawning beds, it reduces survival of salmonid eggs and creates a physical barrier that prevents hatched fry from emerging through interspaces between gravels. Sediment can adversely affect other aquatic wildlife by filling living spaces, covering food supplies, interrupting reproductive functions, and smothering aquatic invertebrates which may be used by fish as food. Siltation of waterways also discourages recreation and inhibits angling for species that are sight feeders. This is particularly critical during the winter steelhead fishing season. The risk of increased sedimentation is greatest when construction activities are in close proximity to streams. Of major significance are stream channel relocations, stream crossings such as bridges and culverts, and construction through stream headwall areas.

Stream channel changes, whether planned or accidental, frequently reduce total aquatic habitat and increase gradients. Increased gradients cause increased velocities, greater scouring and poor habitat. Fish cannot negotiate streams with excessive velocities. It has been demonstrated that streams with undisturbed natural channels will produce several times more fish than streams with altered channels.

Mass soil movements, such as landslides and mudflows may be associated with construction activities, particularly road building. Research substantiates that road construction greatly increases the occurrence of mass soil movement in steep topography such as that comprising more than 50 percent of the analysis area as shown on Map 6. The resulting slides and flows, in addition to increasing stream sediment loads with the effects discussed in the preceding paragraph, may scour stream channels, removing spawning gravel, and block fish passage with accumulated debris.

Accidents (e.g. blow outs, fires, oil spills and dike breaches) or vandalism could destroy vegetation and contaminate surface waters resulting in the destruction of wildlife habitat and the killing of numerous animals including both terrestrial and aquatic species. The aquatic habitat is particularly sensitive to the toxic, water soluable fraction of crude oil which can continue to be released for some time from contaminated stream bottoms.

Aquatic habitat is seriously impaired when stream flow is below a minimum level. Diversion of water for drilling operations could deplete stream flow below the recommended minimum, resulting in serious water temperature increases and oxygen content decreases.

The removal of streamside vegetation, thus exposing the water's surface to direct sunlight, can result in increased water temperatures. If enough exposure results, water temperatures may reach levels destructive to aquatic life.

Clearing of timbered areas for roads, well sites, storage tanks, pipelines and other facilities could destroy nest trees used by Northern Spotted Owls. The greatest potential for such an impact is in areas identified as "crucial spotted owl habitat" on Map 8 .

Noise and activity associated with seismic surveys, road construction, drilling and well operation will disturb terrestrial wildlife species within the more immediate vicinity of such operations.

Roads constructed during exploration or later phases of oil and gas development could open secluded areas used by wildlife to the presence of people and vehicles, resulting in wildlife harassment. Elk are particularly affected by such disturbance and the result could be the injury or loss of newborn calves and/or the forcing of animals into areas where they are more vulnerable to hunters or winter weather. These impacts are most likely to occur in timbered areas indicated as "crucial elk habitat" on Map 8.

Native vegetation, usually consisting of mature and immature timber species will be destroyed and the growing site severely altered by the construction of roads, drill pads, tank batteries, pipelines and other facilities. These impacts would be most severe and could be long term on those sites difficult to revegetate (eg. rocky, shallow soils and steep, southern exposures) and/or on sites where the top soil has been contaminated by oil or chemicals.

Clearing of forested areas for roads, well sites, storage tank areas and other facilities will have a favorable impact upon species of wildlife that utilize forest openings, especially after the abandonment phase.

C. Human Values

A number of oil and gas field operations may produce visual impacts. New roads or trails constructed to facilitate geophysical exploration and pipeline or electrical power line rights-of-way may produce linear features discordant to the natural landscape. Any clearings less than ten feet wide, however, will not generally be noticeable from a distance. Right-of-way clearings greater than ten feet in width tend to create gaps in the forest canopy that produce eyecatching lines.

Roads constructed for access to drilling sites or other field facilities will probably create 40 to 100 foot wide lineal clearings. Such roads would be similar to numerous logging roads in the area. The degree of visual impact will vary according to the specific location. Additional roads would be most conspicuous in the Oxbow Burn where there is no existing vegetative screen to hide them and where transverse cuts in bare hillsides are highly visible discordant lines accentuated by exposed soil coloration.

Clearings made for seismic exploration work or for drilling and production equipment may or may not be visible to the public depending upon specific circumstances surrounding each site.

(a) Drilling sites on steep hillsides and on ridges within the medium sensitivity level viewing zone will probably be visible to a moderate number of forest visitors. Sites adjacent to existing roads will also be visible to persons travelling along those roads.

(b) Drilling sites on rolling hillsides or valley bottoms with a forest screen around them will probably not be visible to the viewing public, except for the derrick which will temporarily extend above the tree line.

When the drill rig clearing site is visible, a rectilinear clearing will be more discordant and offensive to esthetic senses than would be an irregular shaped clearing.

Any timber removal (other than salvage harvest) and emplacement of any permanent structures on the narrow strip of land between the Smith River and the Smith River Road would tend to depreciate the esthetic value of a buffer strip maintained between the road and the river. This buffer strip is recognized in the Management Framework Plan for the Drain Forest Management Area.

Exploration and production equipment, including drilling derricks, storage tanks, electric transmission lines and pipelines placed above ground, may or may not be visible to the public depending upon proximity to travelled roads and whether a timber screen was present or not. Bright colored and reflective paint would accentuate the visibility of equipment.

Surface disposal of drilling mud visible from medium sensitivity roads or developed recreation sites would tend to create a visible unnatural intrusion on the land surface.

Any fires which might result from oil and gas operations could create visible scars upon the landscape depending upon location and size.

The conduct of oil and gas operations on or within 500 feet to half a mile from a developed recreation site could be moderately disruptive of an esthetic recreational experience at the site because of noise and the visibility of equipment. This impact would affect a larger number of visitors during the heavy use summer season. The impact on the use of the site would be greatest if blow outs, spills, or fires occurred or if production equipment were conspicuous and obvious from the principal access road to the site.

Noise and vibrations from equipment operations are not expected to significantly impact the public except near recreation sites and the few scattered residences within the analysis area.

Cultural resources could be destroyed or obscured during any surface disturbing activity such as the construction of roads, drill pads, tank batteries, pipelines and other facilities. The educational and scientific value of a cultural resource, whether historic, archeological or paleontologic, is greatest when that resource is undisturbed. Additionally, the value of a cultural resource may be adversely impacted by adjacent offsite activities which destory, or substanially alter the original setting. An adverse impact might also result should oil spills occur during the production, transport or storage of crude petroleum. The spill could contaminate charcoal samples, rendering them useless for radiocarbon dating.

Discovery of previously unrecorded archeological sites during the exploration and development phases of petroleum operations is a very real possibility. Construction of roads, drill pads and other facilities will necessitate the removal of vegetative cover from areas previously hidden from view. The uncovered areas will facilitate the search for archeological resources.

Increased personal income from royalty payments and increased county revenue from shared royalties and new tax sources represent a major economic benefit from oil and gas development should marketable quantities be discovered.

## POSSIBLE MITIGATING MEASURES

### A. Nonliving Components (Land, Water, Air)

Increased soil erosion and slope failures resulting from construction activities will be similar to those long associated with logging and forest management operations in Western Oregon. It would be appropriate to apply construction practices and considerations similar to those required of forest management construction. Such mitigating measures include, but are not limited to, the following:

(a) Existing roads should be used to the maximum extent possible.

(b) Prohibit construction involving surface disturbance during periods of heavy rainfall - such periods frequently occur during the months of October through April.

(c) Facilities should be designed to the minimum size which will safely accommodate traffic and equipment for the intended use.

(d) Construction design should include facilities to control surface and subsurface drainage eg. perforated pipe, water bars and culverts that discharge on stable material.

(e) Roads and drill pads should be maintained and those intended for wet season or long term use should be surfaced.

(f) Roads and facility sites no longer needed should be ripped, water barred and revegetated as soon as possible.

(g) Road location and design should be such that excavation will not remove support from the base of over-steepened slopes or remove the toe of previous slides.

(h) Cuts and fills and exposed banks should be revegetated by seeding and mulching.

Surface disturbing activities, especially road construction, on those slopes shown as critical areas on Map 6 demand specific construction practices and considerations in addition to those enumerated above. Generally, construction should be prohibited, but there may be areas where construction is possible provided specific mitigating measures are taken, including, but not limited to, the following:

(a) The sidecast of excavated material should be avoided and end haul of such material required especially in steep drainage headwalls.

(b) Cut and fill slopes designed to exceed the normal angle of repose should include slope stabilizing measures, eg. riprap, rock buttresses, bin or retaining walls, piling and horizontal drains.

The impacts of subsidence could be minimized by requiring that a plan, based upon pertinent geologic data, be prepared and implemented to prevent subsidence through the monitoring of fluid withdrawals and the reinjection of fluids as necessary.

The effects of oil and gas operation - induced earthquakes, should any occur, could be reduced or prevented by requiring the lessee to monitor seismic activity in the area and to alter production activity (fluid withdrawal or reinjection).

The effect of landsliding and flooding upon oil and gas facilities and the resulting water and soil contamination could be reduced by proper site selection to avoid flood plains and known unstable slopes.

Impacts to identified potential recreation sites could be mitigated by prohibiting surface occupancy or controlling such occupancy by specifically tailored stipulations applicable to an individual site. Stipulations could cover such items as restricting drilling to existing cleared areas, detailing required rehabilitation and perhaps setting a time limit on occupancy of the site.

Surface occupancy of existing recreation sites and adjacent buffer areas could be prohibited thus avoiding any activities damaging or disruptive to the recreation value of the site.

B. Living Components (Animals, Vegetation)

The impacts of increased sediment and mass soil movement on aquatic wildlife could be mitigated by incorporating those measures from the preceding "Nonliving Components Section" suggested for reducing soil erosion and slope failures associated with construction activities.

The chance of sedimentation of surface waters following construction in close proximity to streams, and the adverse effects on water temperatures of removing streamside vegetation, could be mitigated by requiring the maintenance of a vegetative buffer along the stream bank. Such buffers are particularly important along those streams indicated as crucial fish habitat on Map 9 as well as those tributaries which may affect water quality.

Stream channel relocations should be avoided. If a channel change is necessary, it could be designed to minimize increases in water velocity.

Diversion of water for drilling operations from streams designated as crucial fish habitat on Map 9 could be stopped during periods when such diversion would reduce the stream level below recommended minimums.

Disturbance of Northern-spotted Owls could be minimized by prohibiting the destruction of nest trees. Additionally, any oil and gas activity could be prohibited during the nesting season (February-July) within 300 feet of an occupied nest tree.

Elk harassment within crucial elk habitat areas as located on Map 8 could be mitigated by controlling vehicular access over newly constructed roads and trails. This could be accomplished by gating the roads during use for oil and gas activities and by blocking and reclaiming the road bed when it is no longer needed.

To minimize the long term or permanent loss of growing sites, the impacts of clearing and use for drill pads, tank batteries, pipelines, and other facilities could be mitigated by the following measures.

(a) The removal and stockpiling of top soil to be respread over the site during reclamation.

(b) Replanting of native vegetation common to the site prior to development.

(c) Avoiding disturbance of sites difficult to revegetate (eg. rocky, shallow soils and steep, southern exposures).

C. Human Values

Visual impacts of right-of-way clearing over 10 feet in width for road, trail, pipelines or powerlines could be mitigated by the following:

(a) Use existing rights-of-way to the maximum extent possible.

(b) Fit right-of-way locations to the topography by using topographic and vegetative features in the design and location to minimize the discordant effect of continuous linear clearings.

(c) Revegetate all exposed soil on cut and fill slopes and embankments as soon as possible.

(d) Reclaim and revegetate with native vegetation rights-of-way no longer needed.

Visual impacts of clearings for seismic exploration, drill pads, tank batteries and other facilities could be reduced by the following:

(a) Limit the size of each site to the minimum necessary to accomodate the operation.

(b) Locate clearings so that they will be screened, especially from "medium sensitive" roads (eg. Crow, McBeth, Siuslaw, East Oxbow, Smith River and Timber Ridge) and developed recreation sites.

(c) Design clearings visible from a "medium sensitive" road or a developed recreation site, in an irregular pattern in order to present a natural clearing outline.

(d) Prohibit clearings on exposed skylines.

(e) Prohibit clearing and development on steep slopes where extensive excavation is needed to make a level site.

The esthetic value of the buffer strip between Smith River and Smith River Road could be protected by prohibiting the removal of any vegetative cover or the emplacement of permanent structures or equipment.

The visual impact of exploration and production equipment, including drill derricks, storage tanks and pipelines, visible from "medium sensitive" roads and developed recreation sites could be softened by using nonreflective paints that blend with the surrounding landscape.

The disposal of drilling mud could be prohibited if it would be visible from "medium senstive" roads or developed recreation sites, unless such mud could be mixed into other surface soil and revegetated with native vegetation.

The impact of noise on visitors to recreation sites and residences near operating oil and gas sites could be mitigated by requiring engine mufflers and housings over flowline pumps.

The extent and importance of cultural resources within the analysis area is, in many respects, unknown. Most surveys have been incomplete and somewhat superficial. Mitigation of the inadvertent destruction of cultural resources could be accomplished by requiring a certified, independent survey prior to any operations under terms of an oil and gas lease. The purpose of the survey would be to disclose the existence of antiquities and other objects of historic interest.

## RECOMMENDATIONS FOR MITIGATION

### A. General Oil and Gas Lease Stipulations

Following conditions and stipulations are recommended for use in all leases within the analysis area.

(1) "The Lessee shall contact the Authorized Officer of the Bureau of Land Management prior to development of a plan of operation to be apprised of practices to be followed or avoided in field development, including but not limited to such matters as road standards stream crossings, gates, erosion control, surface rehabilitation and maintenance."

The types of practices which the Authorized Officer will consider are included in Appendix K and Appendix L. Which practices will be appropriate to a given operation depends upon the specific field location of the operation. However, it is felt desirable that all parties be familiar with some of the types of practices that will be considered to establish a basis of communications and understanding.

(2) "No occupancy or other surface disturbance will be allowed on slopes in excess of 60 percent without written approval from the District Engineer, Geological Survey, with the concurrence of the Authorized Officer of the Bureau of Land Management."

(3) "In order to minimize watershed damage, during muddy and/or wet periods the Authorized Officer of the Bureau of Land Management, through the District Engineer, Geological Survey, may prohibit exploration, drilling or other development. This limitation does not apply to maintenance and operation of producing wells."

(4) "Existing roads and/or rights-of-way are to be used to their maximum advantage."

(5) "Facilities shall be designed to the minimum size which will safely accomodate traffic and equipment for the intended use."

(6) "Lessee shall monitor its operations during production phases and initiate changes in production activities to reduce subsidence and/or seismic activity resulting from such production. Such changes may include fluid withdrawal and/or reinjection rates."

(7) "Wells and storage facilities for crude petroleum production shall not be located within natural flood plains."

(8) "When clearing, occupying or operating within close proximity to a stream designated as Class I by the State of Oregon, Lessee shall maintain vegetative buffer zones. The design of said buffer zones shall require the approval of the District Engineer, Geological Survey, with the concurrence of the Authorized Officer of the Bureau of Land Management.

(9) "Prior to any operations under this lease, the Lessee will engage a qualified professional, acceptable to the Authorized Officer, to make a survey of the land to be disturbed or occupied. A certified statement, signed by the qualified professional, setting out the steps taken in the survey and the findings thereof as to the existence of antiquities or other objects of historic or scientific interest, shall be submitted to the Authorized Officer. If the statement indicates the existence of such materials which might be disturbed by operations under this lease, the Lessee shall take such mitigating actions as may be required by the Authorized Officer, including, but not limited to, archeological salvage or protective measures or avoidance of the site, to protect and preserve such objects. Such objects shall remain the property of the Lessor, or the surface owner if other than the Lessor. If cultural resource is discovered during project operations, activities will be stopped until a survey of the materials is completed by a professional engaged by the lessee and acceptable to the Authorized Officer, including but not limited to archeological salvage or protective measures or avoidance of the site, to protect and preserve the materials. Such materials shall remain the property of the Lessor, or the surface owner if other than the Lessor."

(10)"The Lessee agrees that during the life of this Lease he shall comply with:

A. All provisions of the State and Federal Water Quality Standards as they may apply to any waterway, stream, lake or reservoir, on or near the lease area, together with all applicable State and Federal laws and regulations. The Lessee shall also undertake every reasonable measure to minimize damage to waterways, streams, lakes or reservoirs on or near the lease area in connection with any operation under this lease.

B. All applicable State and Federal laws and regulations concerning the use of pesticides, including insecticides, herbicides, fungicides, rodenticides and other similar substances. Prior to the use of such pesticides on the lease area, the Lessee shall obtain from the Authorized Officer, Bureau of Land Management, approval of a written plan for such use. The plan shall state the type and quantity of material to be used, the pest to be controlled, the method of application and such other information as the Authorized Officer may require. All use of pesticides on the lease area shall be in accordance with the approved plan. If the use of a pesticide is prohibited by the Secretary of the Interior, it shall not be used."

(11) The standard surface disturbance stipulation printed as Bureau of Land Management Form 3109-5 and attached as Exhibit D.

B. Lease Specific Oil and Gas Stipulations

The following conditions and stipulations are recommended for use in the specific leases as indicated.

OR 9723

"Prior to any surface occupancy of the NW¼,N½SW¼ of Section 21, T. 19S., R. 7W. or the N½ of Section 27, T. 19S., R. 7W., Will. Mer. Lessee shall develop, with the co-operation of the Bureau of Land Management, an occupancy and development plan. The purpose of such a plan is to preserve the unique characteristics of said area for future recreation development."

OR 9727

"Surface occupancy of the Haight Creek Recreation Site and those lands within 500 feet of the developed perimeter of said site is prohibited. Said site is located in portions of Lots 4,5,10 and 11 of Section 35, T. 19S., R. 7W., Will. Mer. and includes an area of approximately 35 acres."

OR 9729

"Prior to any surface occupancy of the S½NE¼, SE¼ of Section 5, T. 20S., R. 6W., or the W½ of Section 29, T. 19S., R. 6W., Will. Mer. Lessee shall develop, with the co-operation of the Bureau of Land Management, an occupancy and development plan. The purpose of such a plan is to preserve the unique characteristics of said area for future recreation development."

"Surface occupancy of the Regional Forest Nutritional Research Study Installation No. 164, is prohibited. Said installation is located in a portion of the SW¼NW¼ of Section 3, T. 20S., R. 6W., Will Mer. and includes an area of approximately 10 acres."

OR 9732

"Surface occupancy of the Smith Creek Progeny Plantation is prohibited. Said plantation is located in a portion of the S½SW¼NE¼ of Section 13, T. 20S., R. 6W., Will. Mer. and includes an area of approximately 15 acres."

OR 9733

"Lessee shall not remove any vegetation or emplace any structures or equipment in the area between Smith River and the Smith River Road."

OR 9742

"Surface occupancy of the Gunter-Smith River Recreation Site and its buffer area is prohibited. Said site is located in the NW¼SE¼, W½NE¼ SE¼, N½SW¼SE¼ of Section 1, T. 21S., R. 6W., Will. Mer. and includes an area of approximately 80 acres."

"Lessee shall not remove any vegetation or emplace any structures or equipment in the area between Smith River and the Smith River Road."

RESIDUAL IMPACTS

Geologic hazards triggered by natural forces could damage oil and gas field facilities and cause oil spills, mud pit breaches, failures of road fills and other environmental problems during all phases of operations. Landslides could impact field operations if roads, well sites, or other facilities were located on or below unstable slopes.

Land would be temporarily and/or permanently removed from timber production. The amount would vary directly with the degree of oil and gas operations and could become significant if a field is discovered and developed.

Dust from road construction and road use during drier seasons would have a localized adverse effect on air quality.

Smoke from slash fires associated with clearing operations, though controlled to the degree possible by the State of Oregon, could cause a temporary degradation of air quality.

Accidents (e.g. blow outs, fires, oil spills and dike breaches) or vandalism could increase erosion through destruction of vegetation, contaminate surface waters, sterilize soils and temporarily degrade air quality by the discharge of odorous and toxic natural gases. Oil fires, emit smoke and the products of hydrocarbon combustion into the atmosphere.

Accidents (e.g. blow outs, fires, oil spills and dike breaches) or vandalism could destroy vegetation and contaminate surface waters resulting in the destruction of wildlife habitat and the killing of numerous animals including both terrestrial and aquatic species. The aquatic habitat is particularly sensitive to the toxic, water soluable fraction of crude oil which can continue to be released for some time from contaminated stream bottoms.

Noise and activity associated with seismic surveys, road construction, drilling and well operation would disturb terrestrial wildlife species within the more immediate vicinity of such operations.

Any fires which might result from oil and gas operations could create visible scars upon the landscape depending upon location and size.

Information gathered during the first three stages of oil and gas operations may further the knowledge of the stratigraphy, structure and geologic history of the region and may aid future evaluations of mineral and fuel potentials.

Additional road construction associated with exploration and development could also be used for timber management and recreation access.

Clearing of forested areas for roads, well sites, storage tank areas and other facilities would have a favorable impact upon species of wildlife that utilize forest openings, especially after the abandonment phase.

Discovery of previously unrecorded archeological sites during the exploration and development phases of petroleum operations would be a very real possibility. Construction of roads, drill pads and other facilities would necessitate the removal of vegetative cover from areas previously hidden from view. The uncovered areas would facilitate the search for archeological resources.

Increased personal income from royalty payments and increased county revenue from shared royalties and new tax sources represent a major economic benefit from oil and gas development should marketable quantities be discovered.

## IV. RELATIONSHIP BETWEEN SHORT-TERM USE AND LONG-TERM PRODUCTIVITY

Generally, the ecosystems within the analysis area are highly productive and in good equilibrium. The extent of resource commitments and an assessment of the environmental impacts associated with oil and gas leasing have been described in the preceding sections. Except for these commitments, and their short-term environmental effects, little impact on long-term productivity would be expected.

The exploration phase of oil and gas leasing would result in a short-term use of national resource lands. Where such exploration proves unsuccessul, there would not be further use of the lands for resource production. Under such circumstances, a lease would terminate at the end of its 10 year primary term, unless sooner relinquished by the lessee or cancelled for noncompliance.

Where exploration discovers an economically attractive oil or gas resource, development and production would be expected to occur. The production phase would probably continue for several decades until the reserves are depleted. When the reservoir is depleted, the lease would terminate, facilities would be dismantled, and the land restored, insofar as possible, to its original condition.

Because Western Oregon ecosystems are generally quick to recover from both natural and man made abuse, planned site reclamation is expected to be successful. Any loss in long-term productivity would most likely be limited to small, scattered acreages accidently subjected to contamination during drilling or production.

## V. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

The principal irretrievable commitment would be the depletion of oil and gas resources if exploration should discover economic reserves. In addition, there would be the irretrievable consumption of natural construction materials such as sand and gravel for the development of the field, The terrain from which these materials would come would be modified by the development of gravel borrow pits and rock quarry sites.

Significant irreversible commitments stem primarily from the "what if" side of the ledger. For example, massive earth slides, triggered by seismic activity, could cause excessive stream siltation and create permanent marks on the landscape. Subsidence could alter aquifers, impairing permeability and the quantity of subsurface waters. The likelihood of either event is not well known. We can presume, if very tentatively, based upon limited geologic knowledge, that the probabilities would be low.

## VI. INTENSITY OF PUBLIC INTEREST

The proposed oil and gas leasing program for national resource lands within the analysis area has raised a moderate amount of public input.

Sixty letters, requesting technical input or any other comments on the environmental effect of proposed leasing, were sent to interested federal, state and local agencies, interest groups and individuals. We received replies from about one third of those directly solicited. In addition, local newspapers and radio and television media were sent news releases. Three newspapers, a radio station and both local television stations provided coverage, which resulted in comments from about seven individuals.

To date, the comments received range from approval of the proposed leasing, to concern for fish and animal life, to requests for further information to disapproval.

## VII. PERSONS, GROUPS AND GOVERNMENTAL AGENCIES CONSULTED

During January 1976 letters were sent to the following agencies, persons, and groups inviting comments on the effect of oil and gas leasing on the environment of the analysis area.

### Federal Agencies

State Conservationist
Soil Conservation Service
Portland, OR

Branch of Upland Leasing
Bureau of Land Management
Washington, D.C.

Branch of Energy and Minerals
Bureau of Land Management
Denver Service Center
Denver, Colorado

U. S. Forest Service
Region 6
Portland, OR

Special Assistant to the
Secretary - USDI
Pacific Northwest Region
Portland, OR

Pacific Area Oil and Gas
Supervisor
U. S. Geological Survey
Los Angeles, California

Bonneville Power Administration
Portland, OR

Senator Mark O. Hatfield
U. S. Senate
Washington, D.C.

Senator Robert W. Packwood
U. S. Senate
Washington, D.C.

Federal Power Commission
Bureau of Power
Section of Powersite Lands
Washington, D.C.

Rep. James Weaver
House of Representatives
Washington, D.C.

Environmental Protection Agency
Region X
Seattle, Washington

Division of River Basin Studies
Fish and Wildlife Service
Portland, OR

Bureau of Reclamation
Boise, Idaho

### State Agencies

Assistant to Governor,
Natural Resources
Salem, OR

Division of State Lands
Salem, OR

State Clearing House
Salem, OR

Oregon Dept. of Fish and Wildlife
Portland, OR

Oregon Dept. of Environmental Quality
Portland, OR

Water Resources Department
Salem, OR

District Wildlife Biologist
Oregon Dept. of Fish and Wildlife
Eugene, OR

District Fishery Biologist
Oregon Dept. of Fish and Wildlife
Gardiner, OR

District Fishery Biologist
Oregon Dept. of Fish and Wildlife
Eugene, OR

District Wildlife Biologist
Oregon Department of Fish and Wildlife
Albany, OR

State Geologist
Oregon Dept. of Geology and Mineral Industries
Portland, OR

Local Agencies

Lane Council of Governments
Eugene, OR

Lane County Commissioners
Lane County Courthouse
Eugene, OR

Lane County
Division of Parks and Recreation
Eugene, OR

Linn County Commissioners
Linn County Courthouse
Albany, OR

Eugene City Manager
Eugene, OR

Springfield City Manager
Springfield, OR

Cottage Grove City Manager
Cottage Grove, OR

Brownsville City Mayor
Brownsville, OR

County Extension Forester
Lane County Extension Service
Eugene, OR

Groups and Individuals

Executive Director
Oregon Environmental Council
Portland, OR

Executive Director
Oregon Wildlife Federation
Portland, OR

Keep Oregon Green Association
Salem, OR

Oregon Representative
Wilderness Society
Eugene, OR

Western Oil and Gas Association
Los Angeles, California

Mobil Oil Corporation
Los Angeles, California

Oregon Student Public Interest Research Group (OSPIRG)
Portland, OR

Survival Center, ASUO
University of Oregon
Eugene, OR

Oregon Conservation Coordinator
Sierra Club, Pacific NW Chapter
Eugene, OR

Museum of Natural History
University of Oregon
Eugene, Or

League of Women Voters
Eugene, OR

Northwest Timber
Eugene, OR

Department of Geology
University of Oregon
Eugene, OR

Department of Geology
Oregon State University
Corvallis, OR

Upper Willamette Resource Conservation and Development Project
Eugene, OR

Oregon Historical Society
Portland, OR

Western Forest Industry Assoc.
Corvallis, OR

Isaac Walton League
Eugene, OR

Oakridge Audubon Society
Westfir, OR

McKenzie Guardians
Blue River, OR

Environmental Studies Center
University of Oregon
Eugene, OR

Water Resources Research Institute
Air Resources Center
Oregon State University
Corvallis, OR

N W Environmental Defense Center
Portland, OR

Friends of the Earth
San Francisco, California

Industrial Forestry Association
Eugene, OR

Corvallis Center of Environmental Service
Oregon State University
Corvallis, OR

Public notification of the initiation of this environmental analysis and requests for public comments were made through news stories printed or broadcast by the following media:

Eugene Register-Guard
Eugene, OR

Springfield News
Springfield, OR

Willamette Valley Observer
Eugene, OR

KBDF
Eugene, OR

KVAL - TV
Eugene, OR

KEZI - TV
Eugene, OR

## VIII. PARTICIPANTS

This Environmental Analysis Record was prepared by B.L.M. personnel in the Eugene District with technical assistance and information supplied by the following:

David L. Cole - Museum of Natural History, U of O
C. Melvin Aikens - Department of Anthropology, U of O
Edward T. Long - State Historic Preservation Office
Ray Vincent - Creswell, Oregon
James M. Hutchison - Oregon Dept. Fish and Wildlife
Frank Oliver - BLM, Roseburg District
William R. Patching - Soil Conservation Service, Eugene
Ray Banta - Izaak Walton League, Eugene Chapter
Eric Forsman - Dept. Fisheries and Wildlife, OSU
Edmund Harshman - USFS, Willamette Forest
Robert Jubber - Oregon Dept. Fish and Wildlife
Richard King - BLM, Coos Bay District
Larry McQueen - S. Willamette Ornithological Society
Joseph Pesack - Oregon Dept. Fish and Wildlife
Robert Storm - Zoology Dept., OSU
B. J. Verts - Dept. Fisheries and Wildlife, OSU
Dewey Walton - Cottage Grove, Oregon
Robert W. Bright - BLM, Roseburg District
David E. Howell - BLM, Roseburg District

The BLM, Eugene District, interdisciplinary team was:

Ronald E. Bramble - Realty and Recreation Specialist
George R. Chalfant - Soil Scientist
Russel A. Hammer - Fishery Biologist
Joseph P. Hessler - Recreation Planner
Alan D. Schaffer - Environmental Coordinator
Michael D. Southard - Archeologist
Charles L. Thomas - Wildlife
Robert J. Walter - Natural Resource Manager
James E. West - Natural Resource Manager
Ronald O. Wold - Geologist

## IX SUMMARY CONCLUSION

On the assumption that recommended mitigating conditions and stipulations will be appropriately required, there are no major residual, environmental impacts anticipated from the proposed action. Obviously, accidents could result in the contamination of surface waters, soil sterilization and the destruction of vegetation - such could destroy wildlife habitat and numerous animals including both terrestrial and aquatic species. Though recent exploration and development history shows a low accident rate, the potential environmental impact resulting from an accident should be considered significant.

Because Western Oregon ecosystems are generally quick to recover from both natural and man-made abuse, planned site reclamation would most likely be successful. Any loss in long-term productivity would probably be limited to small, scattered acreages accidently subjected to contamination during drilling or production.

It is unlikely that activity beyond the exploration stage will occur on the majority of acres under lease application. Exploration has the least environmental impact of the stages of oil and gas development. The site of past exploration is difficult for most and impossible for many to locate after just a few years following abandonment and reclamation.

## X. SIGNATURES

Alan D. Schaffer
Interdisciplinary Team Leader

MAR 30 1976
Date

James P. Clason
Chief, Division of Resources
Eugene District

MAR 30 1976
Date

APPENDIX A

Lands Included in Oil and Gas Lease Applications
Siuslaw Environmental Analysis Area

OR 9722
T. 18 S., R. 7 W. Willamette Meridian
Sec. 33: Lots 1,2,3,4,5,6,7,8,9,10,11,12,13,14
Sec. 35: All
T. 19 S., R. 7 W.
Sec. 3 : Lots 1,2,3,4; S½N½; N½S½; SE¼SW¼; SE¼SE¼
Sec. 9 : Lots 1,2,6,7,8,9,10,11,12,13,14,15,16

OR 9723
T. 19 S., R. 7 W.
Sec. 15: All
Sec. 21: All
Sec. 27: All
Sec. 33: All

OR 9724
T. 18 S., R. 6 W.
Sec. 31: All
Sec. 33: All
T. 19 S., R. 6 W.
Sec. 5 : All
T. 19 S., R. 7 W.
Sec. 1 : Lots 1,2,3,4; S½N½; N½S½; SW¼SW¼

OR 9725
T. 19 S., R. 6 W.
Sec. 7 : Lots 1,2,3,4; S½NE¼; E½W½; SE¼
Sec. 8 : SW¼NW¼; NW¼SW¼
T. 19 S., R. 7 W.
Sec. 11: SE¼NE¼; SW¼NW¼; S½
Sec. 13: All
Sec. 23: All

OR 9726
T. 19 S., R. 6 W.
Sec. 9: NE¼; N½NW¼; SE¼NW¼; SW¼SW¼
Sec. 15: E½; SE¼NW¼; S½SW¼
Sec. 17: W½NE¼; SE¼NE¼; E½NW¼; NW¼NW¼; S½
Sec. 20: SW¼NE¼; E½NW¼
Sec. 21: All

OR 9727
T. 19 S., R. 6 W.
Sec. 19: Lots 1,2,3,4; NE¼; E½W½; N½SE¼; SW¼SE¼
Sec. 31: All
T. 19 S., R. 7 W.
Sec. 25: N½NE¼; S½SE¼
Sec. 35: Lots 1,2,3,4,5,6,7,8,9,10,11,12,13,14,15

OR 9728

T. 19 S., R. 6 W.
Sec. 13: All
Sec. 23: All
Sec. 25: All
Sec. 27: All

OR 9729

T. 19 S., R. 6 W.
Sec. 29: All
Sec. 33: All
Sec. 34: SE¼NE¼
T. 20 S., R. 6 W.
Sec. 3 : Lots 5, 6, 7, 8, 9, 10,11,12,13,14,15,16,17
Sec. 4 : SE¼NE¼
Sec. 5 : All

OR 9730

T. 19 S., R. 5 W.
Sec. 31: All
Sec. 32: NW¼NW¼
T. 19 S., R. 6 W.
Sec. 35: All
T. 20 S., R. 5 W.
Sec. 5 : All
T. 20 S., R. 6 W.
Sec. 1 : Lots 1,2,3,4,; S½N½; N½SW¼; SE¼

OR 9731

T. 20 S., R. 5 W.
Sec. 9 : All
Sec. 17: NE¼; S½
Sec. 19: All
Sec. 21: N½NE¼, SW¼, NW¼SE¼, S½SE¼
Sec. 29: NE¼, SW¼, NE¼SE¼

OR 9732

T. 20 S., R. 5 W.
Sec. 7 : E½, E½NW¼, Unnumbered lot in NW¼NW¼,
Unnumbered lot in SW¼SW¼, SE¼SW¼
T. 20 S., R. 6 W.
Sec. 11: NE¼NE¼, W½NE¼, E½W½, SW¼SW¼, SE¼
Sec. 13: All
Sec. 23: All
Sec. 24: SW¼SW¼
Sec. 26: N½SE¼, SW¼SE¼

OR 9733

T. 20 S., R. 6 W.
Sec. 15: All
Sec. 21: All
Sec. 27: All
Sec. 33: NW¼NE¼, SE¼NE¼, N½NW¼, SW¼NW¼, SE¼SW¼, SE¼

OR 9734 T. 20 S., R. 6 W.
Sec. 7 : All
Sec. 9 : All
Sec. 17: All
Sec. 19: All

OR 9735 T. 20 S., R. 7 W.
Sec. 1 : All
Sec. 12: W½, NW¼NE¼, SW¼SE¼
T. 20 S., R. 6½ W.

An unsurveyed parcel of land described as follows: Commencing at the Northeast corner of Township 20 South, Range 7 West, Willamette Meridian, thence running Southerly along the East line of said Township and Range to the approximate Southeast Corner of Section 13 said Township and Range and at a point where said line intersects the West line of Township 20 South, Range 6 West; thence running Northerly along the West line of last mentioned Township and Range, to the Northwest Corner of Section 6 of said last mentioned Township and Range, said point also being the Northwest Corner of said Township and Range, thence along a westerly prolongation of the North line of said Township and Range to the Point of beginning, which when surveyed will probably be Sections 1, 12 and 13, Township 20 South, Range 6 1/2 West, Willamette Meridian.

OR 9736 T. 20 S., R. 7 W.
Sec. 2 : SE¼SE¼
Sec. 3 : Lots 1,2,4,5,7,8,9,10,11,12; S½
Sec. 11: All

OR 9737 T. 20 S., R. 7 W.
Sec. 5 : All
Sec. 9 : All
Sec. 15: All

OR 9742 T. 20 S., R. 5 W.
Sec. 31: All
T. 20 S., R. 6 W.
Sec. 25: All
T. 21 S., R. 6 W.
Sec. 1 : Lots 1,2,3,4, SE¼NE¼, SW¼, W½SE¼, NE¼SE¼

OR 13317 T. 18 S., R. 4 W.
Sec. 33: SW¼NW¼
Sec. 35: SE¼NE¼

OR 13318 T. 18 S., R. 5 W.
Sec. 15: NW¼NW¼
Sec. 23: W½SW¼; SW¼NW¼

United States Department of the Interior

OFFICE OF THE SECRETARY
Washington, D.C. 20240

October 6, 1972

ORDER NO. 2948

Subject: Division of Responsibility Between the Bureau of Land Management and the Geological Survey for Administration of the Mineral Leasing Laws - Onshore

Sec. 1. Purpose. The purpose of this Order is to set forth the administrative and management procedures for Departmental onshore mineral leasing and operating activities. The spirit and intent of this Order flow from the Department's mineral management objectives of: orderly and timely resources development, protection of the environment, and receipt of fair market value for leased mineral resources.

Sec. 1(a) Orderly and Timely Resource Development includes the Department's responsibilities to:

(1) Foster, promote, and encourage the exploration for and the production of the mineral deposits from the leasable lands; promote competition;

(2) Encourage the active development of the mineral deposits in the leasable lands in a manner compatible with the use of the same lands for other purposes; assure that mineral developers receive the acreage necessary for economic plant investment, development, and production;

(3) Encourage the maximum ultimate recovery of the mineral deposit; prevent waste; promote the conservation of the mineral resources;

(4) Assure adequate minimum production and diligent development requirements for mineral deposits.

(b) Protection of the Environment includes the Department's responsibilities to:

(1) Assure that mineral exploration and production be conducted with the maximum protection of the environment;

(2) Assure the rehabilitation of disturbed lands;

(3) Assure that precautions are taken to protect public health and safety; and

(4) Assure full compliance with the spirit and objectives of the National Environmental Policy Act of 1969, other Federal environmental legislation, and supporting Executive Orders and regulations.

(c) Receipt of Fair Market Value for Leased Mineral Resources includes the Department's responsibilities to assure the public a fair market value return for the use of public lands and the disposition of its mineral resources.

Sec. 2. Agency Responsibilities. The BLM exercises at the Bureau level the Secretary's discretionary authority to determine whether or not leases, permits, and licenses are to be issued. The Bureau of Land Management is responsible for issuing mineral leases, permits, and licenses, and is the office of record in mineral leasing matters. The Geological Survey is responsible for all geologic, engineering, and economic value determinations for the Department's mineral management program. These determinations include: the mineral characteristics of lease and permit areas; parcelling; amounts of bonds; royalties; unit values; rentals; mineral resource evaluations; reserves; investment, diligent development, and minimum production requirements; and all other terms and conditions relating to mineral operations under leases and permits. Geological Survey exercises the Secretary's delegated authority regarding operations conducted within the area of operation by permittees, lessees, and licensees and determines the actions to be taken by them from the standpoint of the development, conservation, and management of mineral resources under the jurisdiction of the Department. GS will refer to BLM any instances of noncompliance with lease terms requiring cancellation action, and BLM will initiate the necessary action.

For the purpose of this Order, the area of operation is defined as that area of the present and planned mine, oil and gas field, or geothermal resource field exploratory, development, and production operations, as presented in an approved exploration or mining plan, drilling permit, oil, gas, or geothermal field development plan, or plan for the abandonment of wells or operations. The area of operation may cover a fraction of a lease or permit area, or it may cover several lease or permit areas. It encompasses the general area needed for storage piles, spoils piles, tailings ponds, on-project mill sites, flow lines, separators, surge tanks, storage tanks, on-project truck or rail-loading stations, drill pads, mud pits, workshops, compressors, generators, on-project power plants, and other such facilities used for on-project mine, oil and gas field, or geothermal resource field exploratory, development, and production operations.

(a) Environmental Protection. The Bureau of Land Management, in cooperation with the Geological Survey, formulates the general requirements to be incorporated in leases, permits, and licenses for the protection of the surface and non-mineral resources and for reclamation.

The Geological Survey, before approving exploration and mining plans, drilling permits, oil, gas, or geothermal field development plans, or plans for the abandonment of wells or operations, consults with the Bureau of Land Management on the adequacy of the surface use, environmental protection, and reclamation aspects of the plans and will not grant approval if inconsistent with the BLM's recommendations without further discussions with BLM. If differences remain after these further discussions, the resolution is made by the Assistant Secretary--Mineral Resources and the Assistant Secretary--Public Land Management. If required, the Under Secretary resolves any remaining differences. The BLM is responsible for compliance examinations of environmental protection requirements outside the operating area and for reporting infractions to the GS for discussions with, or orders to, the permittee, lessee, or licensee. GS examines operations to ensure compliance with environmental protection and rehabilitation requirements inside the operating area. With respect to approval of access roads, pipelines, utility routes and other surface uses outside the operating area, the Bureau of Land Management has the primary responsibility but obtains the recommendations of the Geological Survey before taking final action. Orders to operators for any remedial action is the responsibility of the Geological Survey.

(b) Expertise. The Geological Survey is responsible for maintaining engineering, geologic, geophysical, economic, and other technical expertise needed by the Department to assure compliance with applicable laws, operating regulations, and the objectives of the Department's mineral management program. The Bureau of Land Management is responsible for maintaining expertise needed by the Department for action on applications filed with BLM under the mineral leasing laws to assure compliance with applicable laws, leasing regulations, and the objectives of the Department's mineral management program.

(c) Contacts with Applicants.

(1) Prior to the issuance of mineral leases, permits, and licenses, the Bureau of Land Management will represent the Secretary in dealing with applicants.

(2) After issuance and during the exploration, development, and production phases of leases, permits, and licenses, and until a lease, permit, or license has terminated (at which time management is the sole responsibility of BLM) the Geological Survey is the sole representative of the Secretary in all matters relating to the supervision of operations.

Sec. 3. Issuance of Mineral Leases, Permits, and Licenses.

(a) Applications. Prior to the issuance of mineral prospecting permits, leases, or licenses, the Bureau of Land Management refers all applications for such permits, leases, or licenses to the Geological Survey for a report as outlined in (b) below.

(1) The Geological Survey is responsible for determining, under the mineral leasing laws and regulations, if sufficient information is known about a mineral deposit to warrant offering the deposit for lease by competitive sale and to notify the Bureau of Land Management of its determinations. If the Geological Survey finds that sufficient information is not available to warrant competitive leasing, it notifies the Bureau of Land Management of its conclusions so that the Bureau of Land Management may issue a prospecting permit or noncompetitive lease, as appropriate. The Geological Survey establishes prospecting requirements for prospecting permits. When lands are to be leased, the Geological Survey determines and reports, as appropriate, on: the mineral characteristics of lease and permit areas; parcelling; amounts of bonds; royalties; unit values; rentals; mineral resource evaluations; reserves; investment; diligent development and minimum production requirements; and all other terms and conditions pertaining to lease operations, including environmental and surface rehabilitation stipulations relating to mineral exploration and extraction. With respect to applications for licenses, the Geological Survey determines and reports as to whether the license may be issued.

(2) The Geological Survey is responsible for determining whether a prospecting permittee has demonstrated that the lands contain a mineral deposit having the characteristics required by law and regulations to qualify for a preference right lease and to notify the Bureau of Land Management.

(3) The Bureau of Land Management refers to the Geological Survey all other type applications received which, if approved, may affect operations on existing permits, leases, or licenses.

(4) The Bureau of Land Management notifies the Geological Survey of known oil, gas, and geothermal resource geophysical exploration activity, including the area involved, the type of survey employed, and the name of the operator.

(5) All applications for noncompetitive oil and gas, mineral, and geothermal resource leases filed with the Bureau of Land Management will, prior to issuance of a lease, be referred to the Geological Survey for a determination as to whether the lands are within a known geologic structure (KGS), a known geothermal resource area (KGRA), or a known leasing area (KLA).

(b) Mineral Resource Evaluation Report. GS is responsible for submitting a report of its findings, mineral resource evaluations, and resultant recommendations to the BLM, together with a summary explanation of how the resource evaluations were developed from geophysical, geologic, economic, and engineering data available at the time of the evaluation. The BLM reviews these findings and recommendations in light of multiple-use management requirements and will not issue leases or permits inconsistent with the findings and recommendations without further discussion with GS. If differences remain after further discussion, the resolution is made by the Assistant Secretary--Mineral Resources and the Assistant Secretary--Public Land Management. If required, the Under Secretary resolves any remaining differences.

(c) Competitive Lease Sales. The Bureau of Land Management advertises and conducts competitive lease sales. The Geological Survey's resource evaluations will be used and the Geological Survey will have representatives at the sale and renders a post-sale recommendation to BLM regarding acceptance or rejection of the bids, which must be confirmed in writing.

(d) Files and Records. BLM maintains the official application, permit, and lease case files and forwards to the Geological Survey a copy of each permit, lease, and license, together with copies of relevant correspondence thereafter conducted by the Bureau. The GS forwards to the BLM copies of mining and exploration plan applications, drilling permit applications, and relevant items submitted by the applicants directly to the GS, except confidential proprietary information cited under paragraph (e) below.

(e) Security of Information. The Geological Survey is responsible for receiving and protecting for the confidential use of the Federal Government all proprietary geological, geophysical, engineering, economic, statistical, or other information, mineral resource data, and well logs required to be submitted under Title 30 CFR, Parts 200, 211, 216, 221, 231, 270, and related regulations. The Survey Office receiving such information is designated the Office of Control for those data. Authorized officials of BLM or other surface-managing agencies having a need to see such information will normally make appropriate arrangements to visit the Office of Control for access to such data and for technical advice based on it pertinent to their management responsibilities.

Sec. 4. Mineral Reports. The Geological Survey is responsible for preparing and submitting to the Bureau of Land Management mineral classification and evaluation reports with respect to the leasable mineral value of lands within proposed exchanges, withdrawals, sales, land entries, or other disposals and all other land transactions. The Geological Survey, upon request, also prepares and furnishes mineral reports and other information to the Bureau of Land Management needed for its use in long-range multiple-use planning or inventory of the public lands.

Sec. 5. General Relationships. Such additional references, reports, interchange of information, and advice shall be made by or between the Bureau of Land Management and Geological Survey as may be necessary to perpetuate or improve current practice and provide effective administration of the mineral leasing laws.

The Bureau of Land Management and the Geological Survey must submit to each other for review and recommendations any proposed changes in standard lease terms, regulations, instructions, or other changes that would affect each agency's management responsibilities.

Sec. 6. Implementation of Order. It is intended that there will be no duplication by the BLM or GS of the functions assigned by this Order. BLM and GS will promptly bring their manuals and instructions into agreement with the terms and the spirit and intent of this Order.

Sec. 7. Revocation. The Secretary's instruction (procedures relating to the administration of the mineral leasing laws - General Land Office and Geological Survey) dated September 22, 1925 (51 L. D. 219) is revoked .

COOPERATIVE PROCEDURES PERTAINING TO

ONSHORE OIL, GAS, AND GEOTHERMAL RESOURCES

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IMPLEMENTATION OF

SECRETARIAL ORDER NUMBER 2948

## COOPERATIVE PROCEDURES

These procedures provide for the mutual cooperation between US Geological Survey (GS) and the Bureau of Land Management (BLM) concerning oil, gas and geothermal resources operations in accordance with Secretarial Order No. 2948.

The designation of BLM in this agreement shall refer to the responsibilities of the BLM District Managers in the Western States or to the Director of the Eastern States Office, as applicable.

The designation of GS in this agreement shall refer to the responsibilities of the District Engineers, the Alaska Area Oil and Gas Supervisor, the Western Area Geothermal Supervisor, and in some instances, the Eastern Area Oil and Gas Supervisor, as applicable.

This agreement pertains to the cooperative procedures between the two Bureaus with respect to oil, gas, or geothermal resources operations conducted within an area of operation on those leases where BLM is the responsible surface managing agency or, where reserved minerals are involved.

In the event of a conflict between special lease stipulations and the instructions herein contained, this agreement shall prevail. With only those exceptions herein specified, the GS shall be the sole representative of the Secretary with respect to direct contact with the leasees and operators in matters related to operations as is specified on page 3, section 2(c)(2) of Secretarial Order No. 2948.

For the purpose of this working agreement, the Area of Operation (AO) shall be outlined on the map attached to the approved plan of operations in accordance with the following definitions:

1. For an exploratory well: For wells two miles or more from the nearest producing well the AO shall be established as 160 acres if an oil or geothermal resources test and 640 acres if a gas test.

2. For a producing field: For wells within or adjacent to producing fields, the AO shall embrace the actual acreage then spaced for production from the target reservoir plus, if necessary, the spacing unit for the well then under consideration. For wells outside the established productive limit of a field but within two miles thereof, the AO shall be the same size as the spacing unit then established for wells in the nearby field. However in any instance where the well is projected to test a reservoir not then productive within two miles of the location, the AO shall be 160 acres if an oil or geothermal resources test and 640 acres if a gas test.

Should a well projected as oil test be completed as a gas well, or vice versa, any additional surface use required by such completion will be subject to the pertinent approval procedures hereinafter set forth.

Regardless of the AO so established, the GS shall be solely responsible for all oil, gas, or geothermal resources operations conducted thereon including the enforcement of the surface protection and rehabilitation requirements for approved surface use areas whereon such operations are normally conducted as follows:

a. Well sites - includes the area required for drilling and/or producing the well, normally 3 to 5 acres.

b. Tank batteries and treatment area - actual use areas as established by the approved plan of operations.

c. Gathering lines to and from the wells to the tank batteries or treatment facilities and access roads covered by the approved plan of operations.

For additional surface uses related to operations inside the AO but outside the production facilities or operations areas defined above, and not covered by an approved plan of operations, the operator shall submit his proposed plan of operations to the GS. The GS will not approve any such plan for additional surface uses until the requirements of Part D of this agreement have been satisfied. For surface uses within the AO other than those related to operations, surface user (oil, gas, or geothermal resources operators, or other parties such as recreationists, special use permittees, etc.) shall submit their proposals directly to BLM who shall consult with GS to prevent or reduce any surface use conflicts. BLM will not approve any surface use within an AO which is contrary to GS recommendations without further discussions with GS. Any unresolved issues will be referred to appropriate Departmental officials for resolution.

All surface use requirements outside the limits of established Areas of Operations shall be the sole responsibility of the BLM.

The Surface Disturbance Stipulations, Form 3109-5 (August 1973), which will be made a part of each oil and gas and geothermal resources lease, requires that the operator, prior to his entry upon the land or the disturbance of the surface thereof for drilling or other purposes, shall furnish both the GS and the appropriate surface managing agency with a copy of a map and an explanation of the nature of the anticipated activity and surface disturbance. Maps furnished in this regard will not be accepted if on a scale less than one inch to the mile. A similar stipulation will be included in geothermal resources leases. Work such as surveying for a well site or access route is covered by this stipulation.

Upon receipt of the required map and the explanation of the proposed activity and if BLM is the surface managing agency, or, where reserved minerals are involved, the GS will:

1. Contact both the operator and the BLM to schedule a coordinated joint field examination of the area if such inspection is deemed necessary by GS. In those instances where an inspection is considered unnecessary, the GS will not proceed further without first contacting BLM as to its need for a field inspection. If BLM desires such an inspection, GS will coordinate arrangements with the operator, participate in any such inspection, and furnish appropriate data. If neither bureau requires an inspection, no further action is necessary until such time as an application for permit to drill is filed with the GS. The time for any such inspections will be scheduled as soon as possible, considering work priorities; however, the BLM will, in most instances, not be requested to set an inspection date that falls less than seven days from the date on which it is established that either one or both require an on-site examination. In no event will the GS make a commitment to the operator as to when the inspection will be conducted until after BLM and GS have agreed upon a mutually acceptable date. This time may be reduced for high priority situations. The GS will encourage operators to file such maps and explanations well in advance of the date on which they wish to enter upon the leasehold.

2. Confer with BLM and the operator to select the most feasible and environmentally acceptable areas for:

   a. Well sites (Geologic factors and both Federal and State regulations must be considered).

   b. Access routes.

   c. Any other proposed surface use.

3. Delineate on the maps supplied by the operator, the AO which shall be established in accordance with the foregoing, the surface use activiity areas within the AO which are directly related to the proposed operations, and the access route to the AO and the surface use areas which were tentatively approved by BLM, GS, and the operator in the joint field examination.

4. Encourage the operators to submit preliminary field development plans or drilling schedules to permit lead time for evaluating environmental considerations, resource conflicts, land use planning alternatives and revised plans prior to official submission. Furnish BLM such plans or schedules.

5. Take note of the resources which will be affected, the conflicts that may occur, and also the environmental impacts which are anticipated if the activity use takes place.

6. Furnish any information requested by BLM should BLM determine that it must prepare an environmental analysis record (EAR).

7. Request BLM's surface protection and rehabilitation requirements for the contemplated surface use areas involved which will be made part of any subsequently approved plan of operations for such AO. Upon receipt of the required map and the explanation of the proposed activity, the BLM will:

1. Review the Unit Resource Analysis and Management Framework Plan for the Resource Area, noting existing or alternate access routes, existing and proposed resource uses in the area, what resources will be affected by the proposed use, known archeological sites, etc.

2. Notify the GS in those instances where BLM determines that there is a need for a joint field inspection. However, in those instances where BLM considers an inspection to be unnecessary, it will participate in a joint inspection if GS desires such an examination and will, regardless of whether a joint on-site inspection is made, furnish GS with its surface protection and rehabilitation requirements.

3. Delineate on the maps furnished by the operator such items as existing or alternate access routes if not shown, and furnish the GS this information.

4. Confer with the GS and the operator to select the most feasible and environmentally acceptable areas for:

   a. Well sites (Geological factors and both Federal and State regulations must be considered).

   b. Access routes.

   c. Any other proposed surface use.

5. Delineate on the maps supplied by the operator, the AO which shall be established in accordance with the foregoing, the surface use activity areas within the AO which are directly related to the proposed operations, and the access route to the AO and the surface use areas which were tentatively approved by BLM, GS, and the operator in the joint field examination.

6. Take note of the resources which will be affected, the conflicts which may occur; and also the environmental impacts which are anticipated if the activity use takes place.

7. Where significant surface disturbances will occur as a result of surveying operations, prepare an environmental analysis record (EAR) with respect to such activity.

## B - PROCESSING AND ISSUANCE OF A DRILLING PERMIT INVOLVING FEDERAL OIL AND GAS OR GEOTHERMAL RESOURCES LEASES

GS will:

1. Where BLM is the surface managing agency, or where reserved minerals are involved, send a copy of all applications for permits to drill exploratory and development wells, including the development plan and other appropriate information, to the proper BLM office immediately upon receipt of each such application (in high priority situations, the BLM will also be contacted verbally to expedite issuance of a drilling permit). Other appropriate data include the "12-point plan" required by the GS but not subsurface data or other proprietary information will be furnished BLM.

   a. If the application is based on and follows closely the arrangements tentatively agreed upon at a preliminary joint field inspection as outlined in Section A., a second joint inspection will not be necessary.

   b. If the application deviates appreciably from the arrangements tentatively agreed upon at a preliminary joint field inspection as outlined in Section A, or if there has not been a preliminary joint field inspection, the procedure outlined in 2 and 3 below will be followed.

2. Contact the appropriate BLM office and the operator to establish a time and place to meet for a joint inspection of the drill site and access route for all exploratory well proposals and for development wells, if such inspection is deemed necessary by GS. In those instances where an inspection is considered unnecessary, the GS will not proceed further without first contacting BLM as to its need for a field inspection. If BLM desires such an inspection, GS will coordinate arrangements with the operator, participate in any such inspection, and furnish appropriate data. Whether or not either bureau requires an on-site examination, BLM's surface protection and rehabilitation requirements will be requested and made a part of the approved plan of operations. The time for these inspections will be scheduled as soon as possible, considering work priorities; however, the BLM will, in most instances, not be requested to set an inspection date that falls less than seven days from the date on which it is established that either one or both require an on-site examination. In no event will the GS make a commitment to the operator as to when the inspection will be conducted until after BLM and GS have agreed upon a mutually acceptable date. This time may be reduced for high priority situations. The GS will encourage operators to file all such applications well in advance of the time they wish to enter upon the leasehold.

3. Schedule, insofar as possible, each inspection so that several future drill sites, access roads, etc., can be inspected at one time.

4. Prepare an environmental impact analysis (EIA) 1/ utilizing BLM input for either 1(a) or 1(b) of this Part B on all exploratory wells and development wells which GS determines to be required. Furnish BLM a copy of the EIA (the GS worksheet, Form 2-A, will not be furnished) or a statement of why one was not prepared for inclusion in BLM's official case file. All EIA's prepared in this regard will take into consideration the total aspects of the proposed operations including access to the AO and the proposed surface use areas within the AO.

Supply relevant data requested by BLM in those instances where it is determined that an EIA is not required but BLM finds it necessary to prepare an EAR to complete its records.

5. Prepare the environmental impact statement if the EIA indicates that one is necessary in order to comply with requirements of Section 102 (2)(c) of the National Environmental Policy Act of 1969.

6. Delineate the AO and the approved surface use areas within the AO, including the access route to the AO and the surface use areas on the maps provided by the operator and make such map a part of the approved plan of operations. If a field examination is required, the delineation of the surface use areas shall not be made until after the field examination and mutual agreement is reached with BLM.

7. Where privately owned surface is involved in the surface use areas or access thereto, the operator will be required to furnish a copy of the contract or agreement with the private surface owner.

8. Supply the operator with the name, address, and both the home and office telephone numbers of the BLM contact who will be available for consultation during construction and rehabilitation activities.

9. Furnish BLM the name, address, and both the office and home telephone numbers of the GS Supervisor or the District Engineer to contact in case of emergencies or incidents of noncompliance with the surface use and rehabilitation requirements of the lease or approved plan of operations.

10. Furnish immediate notification of all approved drilling permits to the appropriate BLM office.

11. Require the operator to notify the GS of the exact day field operations will begin in areas where significant surface values, such as archaeological sites, require special protection. GS will immediately notify the BLM of such date.

12. Advise the operator that the GS will expect full compliance with the applicable laws, regulations, and the approved plan of operations, and further, that the GS will consider the operator to be fully responsible for the actions of his subcontractors.

1/ Corresponds to BLM environmental analysis record (EAR).

13. Require all activities to be conducted so as to conform to the approved plan of operations and subsequent amendments made thereto by GS or requested by BLM. BLM may not directly amend any approved plan of operations but may suggest changes to GS which it believes should be incorporated as a result of circumstances not contemplated at the time the plan was first approved. The GS will not approve any plan of operations which is inconsistent with BLM recommendations as to surface protection and rehabilitation requirements. Any unresolved disagreement with the original permit conditions or proposed amendments thereto will be referred to appropriate Departmental officials for resolution under procedures established by Section 2(a) of Secretarial Order No. 2948.

BLM will:

1. Upon receipt of the application for a drilling permit forwarded by the GS, notify the GS immediately in those instances where BLM determines that there is a need for a joint field inspection. However, in those instances where BLM considers an inspection to be unnecessary, it will participate in a joint inspection if GS desires such an examination and will, regardless of whether a joint inspection is made, furnish GS with its surface protection and rehabilitation requirements.

2. Provide GS with the name, address, and both the office and home telephone numbers of the BLM representative who will be available for consultation during construction and rehabilitation activities.

3. Furnish input data to GS for use in the preparation of an EIA. Where GS determines that no EIA is required, BLM may individually, as it determines necessary, prepare an EAR to complete its records. BLM will furnish GS with a completed copy of its EAR.

4. Make a recommendation to the GS as to whether an Environmental Impact Statement is needed.

5. Furnish the GS with a report, within five working days following the joing inspection or within five working days after receipt of the application for a permit to drill if no joint inspection was deemed necessary by either bureau, setting forth the recommendations and requirements necessary to protect the surface resources and the rehabilitation requirements to be included in the drilling permit. The report shall confirm in writing and delineate on a map the AO, the surface use areas within the AO, and the access route to the AO and the surface use areas as agreed upon between BLM, GS, and the operator during their joint inspection or as a result of discussions, or both. For high priority situations the BLM representative may, with the concurrence of the District Manager, verbally inform the GS representative of the BLM requirements for the drilling permit. This verbal communication shall be followed up with a written report to the GS within five days thereafter.

6. At the request of GS, work directly with the operator in the rehabilitation of disturbed areas.

7. Contact Federal and State agencies and other operators in the area for information which will be helpful in implementing a successful rehabilitation program.

8. Make available to the GS and the operator any known or new rehabilitation procedures for the specific area of operation.

9. Provide GS with a written declaration prior to the commencement of drilling operations, as to whether or not a water well is desired in case the well encounters a useable fresh water zone and is later abandoned. If at abandonment, BLM elects to assume further responsibility for the well, it will reimburse the operator for any recoverable casing left in the hole solely because it is to be completed as a water well. The payment shall be based upon cost figures supplied by the operator prior to abandonment.

The operator will abandon the well to the base of the deepest, fresh water zone of interest as required by the GS and will complete the surface clean up operations as required by the drilling permit. BLM will accept liability for the well after GS has approved the abandonment and the surface clean up operations have been completed to BLM's satisfaction. BLM will furnish GS with a written acceptance of all future responsibility for the well including its proper abandonment when it is no longer needed as a water well. In the event BLM requires a quitclaim deed from the operator, a copy thereof will be furnished to GS.

C-COMPLIANCE WITH TERMS AND CONDITIONS
EMERGENCY SITUATIONS

GS will:

1. Make periodic checks to insure that the operator is in compliance with terms and conditions of the lease and is conducting operations in accordance with the applicable regulations and the approved plan of operations.

2. Seek BLM assistance and expertise in surface management problems involving noncompliance with terms and conditions or stipulations, or for modifications requested by the operator.

3. Notify BLM of noncompliance which may require rehabilitation.

4. As appropriate, request the BLM to make inspections to assure compliance with the surface protection requirements of the approved plan of operations.

5. Seek all available help, including BLM, on major accidents or spills involving flowline or lease gathering facility spills, breaks in sludge pits, etc. Seek BLM expertise in rehabilitation and clean up operations.

BLM Will:

1. Conduct inspections to insure compliance with the surface protection requirements of the lease and the approved plan of operations and will note operator noncompliance therewith. Except in an emergency, no contact will be made with the operator or his subcontractors without GS approval.

2. Notify GS immediately of all such incidents of noncompliance with the surface protection requirements of the lease or approved plan of operations.

3. Contact the operator directly only in cases involving an emergency such as accidental spills, flowline breaks, or other situations endangering health, safety, or significant resources.

GS will be immediately notified of any such actions taken by BLM. At that time GS will assume jurisdiction to expedite the necessary operations to resolve the emergency and will request BLM's assistance as needed in matters of surface clean up and rehabilitation.

4. If requested, furnish help during and after emergency for clean up operations, and also furnish expertise for any required rehabilitation.

## D-MAINTENANCE OF FIELD ACTIVITIES INSIDE THE AREA OF OPERATION

GS will:

1. Require operators to file for approval a suitable plan with GS prior to undertaking any new construction, reconstruction or alteration of facilities, including roads, dams, reservoirs, etc., which will result in additional surface disturbance.

Operator must submit to GS enough information concerning the proposed activity to allow evaluation of possible surface disturbance.

2. Notify BLM of the proposed surface disturbing activity and furnish all available information.

3. Process the proposed plan only after receiving the input of BLM with respect to surface protection and rehabilitation requirements and make such requirements a part of the approved plan.

4. Make its approval of the plan subject to such conditions as shall be mutually agreeable to both the GS and BLM.

5. Make periodic inspections to assure that the operator is properly maintaining the facilities.

BLM will:

1. Respond timely to GS's notification that a plan has been filed for additional surface use within an AO by providing its recommended surface protection or rehabilitation requirements.

2. When requested by the GS, assist in resolving noncompliance with the terms and conditions or stipulations of any approved plan.

3. Make periodic inspections to assure that the operator is complying with the surface protection and rehabilitation requirements of the lease and the approved operating plan and will notify GS when it becomes aware of any operating condition warranting correction. The BLM, on its own initiative, may make recommendations to GS for the maintenance or rehabilitation of existing conditions adversely affecting the surface or other resources within an AO.

4. Notify GS of all applications, which involve other surface uses of the lands within the AO for GS recommendations prior to approval of the application.

## E-SURFACE USE MANAGEMENT OUTSIDE THE AREA OF OPERATION

BLM will:

1. Resolve surface use conflicts to the satisfaction of all users if possible; failing this, BLM will take appropriate steps to eliminate the conflict generally with priority consideration given to the continued mineral development. In that regard the comments and recommendations of the GS will be requested.

2. Work directly with all surface users in the area, including operators, regarding maintenance of roads and other support facilities, preventing damage to the surface resources, and encouraging public health and safety awareness.

3. Notify GS of all applications involving lands outside the AO where surface use may cause conflicts. Approval of applications will be based upon all considerations including recommendations from the GS.

GS will:

1. Contact BLM immediately if it becomes aware of any conflicts involving surface use.

2. Make recommendations to BLM if production facilities are being vandalized so protection measures, such as limiting or restricting public access into the area, may be initiated.

3. Make recommendations to both the operator and BLM to improve public health and safety conditions and other conditions such as road maintenance in the general area.

4. Work with BLM to resolve any surface use conflicts which may arise.

GS will:

1. Notify BLM of cancellation or termination of any approved plan of operations under which no activity has taken place.

2. Send BLM a copy of all notices of intention to abandon. If the lease is to remain in effect, any proprietary data contained in a notice will be deleted. If that portion of the approved plan of operations covering surface rehabilitation does not contain information as to whether the well's casing is to be cut off below the ground surface or the abandonment marker is to be waived, or both, the BLM will be orally contacted for its recommendations.

3. Approve the surface and subsurface plugging program to be followed by the operator.

4. Not approve the abandonment of a well where BLM has furnished a written declaration of its interest in acquiring that well should it encounter useable fresh water, without first supplying BLM with the operator's estimated cost of the casing to be left in the hole and the opportunity to assume future responsibility for the well. GS will provide as much advance notice as is possible but it is recognized that in many instances it will be necessary that BLM's decision be made within a few hours after notification of the proposed abandonment.

5. As necessary, request that BLM work directly with the operator concerning surface rehabilitation.

6. Approve the subsequent report of abandonment only after a joint inspection by BLM and GS confirms that surface rehabilitation requirements of the approved plan of operations have been completed satisfactorily.

BLM will:

1. Upon being notified of the pending abandonment of a well which encountered useable fresh water and being furnished with the operator's estimated cost of the casing to be left in the hole, make a decision within the time allowed by GS as to whether it wants the well and will pay the attendant costs thereof.

2. Upon request, advise GS if the well's casing should be cut off below ground surface.

3. Upon request, advise the GS whether the required surface abandonment marker should be waived.

4. When requested by GS, work directly with the operator concerning surface rehabilitation.

5. Notify GS of any failure on the part of the operator to undertake surface rehabilitation measures which are required by the approved plan of operations.

6. Initiate action to have the operator's surety company perform the required rehabilitation if all efforts to secure operator's compliance with the pertinent provisions of the approved plan of operations are unsuccessful.

7. Contact the surface owner where private lands are involved to ascertain acceptance of the surface rehabilitation provided, however, that in no event shall the operator be required to perform surface rehabilitation in excess of that required by his prior contract or agreement with the private surface owner.

8. Notify GS of operator's satisfactory completion of surface rehabilitation.

GS will:

Coordinate and communicate with lessees and operators and BLM concerning area development plans and other information requirements prior to submission of drilling applications.

BLM will:

If requested by GS, communicate with lessees and operators prior to submission of drilling applications to expedite BLM's input concerning surface management and rehabilitation requirements.

BLM and GS will:

1. Periodically hold joint meetings with lessees, operators, contractors, and other involved parties to discuss problems, stipulations, working agreements, and other items of common concern.

2. Meet together periodically at the BLM State Office and GS Area Office level to discuss past and future procedures under these instructions.

3. Offer suggestions for revision of these procedures to their Washington Offices for improving their workability and to reduce duplication of effort in conducting these cooperative activities.

Form 3040-1
ovember 1970)
(formerly 3107-1)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

# NOTICE OF INTENT TO CONDUCT OIL AND GAS EXPLORATION OPERATIONS

| Name | Address *(include zip code)* |
|---|---|
| | |

hereby files this "Notice of Intent to Conduct Oil and Gas Exploration Operations" across and upon *(give description of lands by township(s) and range)*

The type of operation to be pursued is ☐ magnetometer ☐ seismograph ☐ other *(specify)*

Approximate date of commencement of operations Upon completion of work, the Bureau of Land Management District Manager shall be furnished a "Notice of Completion of Oil and Gas Exploration Operations."

The undersigned agrees that oil and gas exploration operations will be conducted pursuant to the following terms and conditions:

1. Exploration operations shall be conducted in compliance with all Federal, State and County laws, ordinances or regulations which are applicable to the area of operations including, but not limited to, those pertaining to fire, sanitation, conservation, water pollution, fish and game. All operations hereunder shall be conducted in a prudent manner.
2. Due care will be exercised in protecting lands in this notice. All necessary precautions shall be taken to avoid any damage other than normal wear and tear, to gates, bridges, roads, culverts, cattle guards, fences, dams, dykes, vegetative cover and improvements, and stock watering and other facilities.
3. Appropriate procedures shall be taken to protect any shafts, pits or tunnels, and shot holes shall be capped when not in use to protect the lives, safety, or property of other persons or of wildlife and livestock.
4. All vehicles shall be operated at a reasonable rate of speed, and due care must be taken to safeguard all livestock and wildlife in the vicinity of his operations. Bulldozers shall not be used without advance notification to the District Manager. Existing roads and trails shall be used wherever possible; if new roads and trails are made, care should be taken to follow natural contours of the lands where feasible and restoration and/or reseeding, as requested by District Manager shall be made.
5. Upon expiration, revocation or abandonment of operations conducted pursuant to this "Notice," all equipment shall be removed from the land and the land shall be restored as nearly as practicable to its original condition by such measures as the District Manager may specify. All geophysical holes must be safely plugged. Upon leaving the land, the District Manager shall be informed.
6. Upon request, the location and depth of water sands encountered shall be disclosed to the District Manager.
7. The party conducting such operations shall contact the District Manager prior to actual entry upon the land in order to be apprised of the practices which should be followed or avoided in the conduct of his operations in order to minimize damages to property of the United States.

| (Signature) | (Signature of Geophysical Operator) |
|---|---|
| (Address including zip code) | (Address including zip code) |



GPO 831-359

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

# SURFACE DISTURBANCE STIPULATIONS

Area Oil and Gas Supervisor or
District Engineer *(Address, include zip code)*

Management Agency *(name)*

Address *(include zip code)*

1. Notwithstanding any provision of this lease to the contrary, any drilling, construction, or other operation on the leased lands that will disturb the surface thereof or otherwise affect the environment, hereinafter called "surface disturbing operation," conducted by lessee shall be subject, as set forth in this stipulation, to prior approval of such operation by the Area Oil and Gas Supervisor in consultation with appropriate surface management agency and to such reasonable conditions, not inconsistent with the purposes for which this lease is issued, as the Supervisor may require to protect the surface of the leased lands and the environment.

2. Prior to entry upon the land or the disturbance of the surface thereof for drilling or other purposes, lessee shall submit for approval two (2) copies of a map and explanation of the nature of the anticipated activity and surface disturbance to the District Engineer or Area Oil and Gas Supervisor, as appropriate, and will also furnish the appropriate surface management agency named above, with a copy of such map and explanation.

An environmental analysis will be made by the Geological Survey in consultation with the appropriate surface management agency for the purpose of assuring proper protection of the surface, the natural resources, the environment, existing improvements, and for assuring timely reclamation of disturbed lands.

3. Upon completion of said environmental analysis, the District Engineer or Area Oil and Gas Supervisor, as appropriate, shall notify lessee of the conditions, if any, to which the proposed surface disturbing operations will be subject.

Said conditions may relate to any of the following:

(a) Location of drilling or other exploratory or developmental operations or the manner in which they are to be conducted;

(b) Types of vehicles that may be used and areas in which they may be used; and

(c) Manner or location in which improvements such as roads, buildings, pipelines, or other improvements are to be constructed.

Form 3109–5 (August 1973)



GPO 849-258

Geological Survey

[NTL–6]

## FEDERAL AND INDIAN OIL AND GAS LEASES

### Approval of Operations

Notice is hereby given that the Geological Survey proposes to formalize its procedures for approval of all applications for permits to conduct operational or construction activities on onshore Federal and Indian oil and gas leases. The proposed Notice also prescribes the information which a lessee or operator must submit in support of applications to conduct operations.

Interested parties may submit written comments, objections, and suggestions to the Chief, Conservation Division, U.S. Geological Survey, National Center, Mail Stop 650, 12201 Sunrise Valley Drive, Reston, Virginia 22092, on or before December 14, 1975.

It is hereby certified that the economic and inflationary impacts of proposed Notice to Lessees and Operators, NTL–6, have been carefully evaluated in accordance with OMB Circular A–107.

V. E. McKelvey,
*Director.*

NOTICE TO LESSEES AND OPERATORS OF FEDERAL AND INDIAN ONSHORE OIL AND GAS LEASES (NTL–6)

Pursuant to the National Environmental Policy Act of 19 (83 Stat. 852), the Department of the Interior is charged with the responsibility of assuring that oil and gas operations on leased lands under its jurisdiction are conducted with due regard for the protection of the environment. Therefore, all operations which are conducted on onshore Federal and Indian oil and gas lease must conform to the requirements of this Notice as well as those contained in the lease and in the Oil and Gas Operating Regulations, Title 30 CFR Part 221.

### I. General

In order that the environmental impact of proposed operations may be properly evaluated, all applications to conduct leasehold operations or construction activities must be accompanied by an appropriate surface use plan. As a minimum, such applications and surface use plans must provide a detailed description of the technical aspects of the proposed operation or activity, the magnitude of surface disturbance involved, and the procedures to be followed in rehabilitating the surface once the operation or construction activity has been completed. Specific requirements in this regard are set forth in Sections II(B), III, and V hereof. One copy of the surface use plan must be attached to each copy of the application to conduct operations or construction activities.

Applications to conduct operations or construction activities with attached surface use plans should be filed at least 30 days in advance of the contemplated starting date of any operation or construction activity in order to allow sufficient time in which to schedule and conduct, if necessary, a joint field inspection by appropriate personnel of the Geological Survey, the Federal surface management agency, the lessee or operator, and, if practical, the lessee's or operator's contractors and subcontractors who will perform the work. However, the early filing of an application is no guarantee that approval thereof will be granted within the 30-day period, as environmental considerations or current workload in the affected Federal agencies may result in further delay.

Lessees and operators have the responsibility to see that their exploration, development, production, and construction operations are conducted in a manner which (1) affords maximum safeguards for the environment; (2) results in the proper rehabilitation of disturbed lands; and, (3) assures the protection of the public health and safety. In that regard, lessees and operators will be held fully accountable for their contractors' and subcontractors' compliance with the applicable laws, regulations, and the requirements of the approved permit and surface use plan.

All approvals of proposed operations as well as subsequent instructions and regulation thereof will come from the District Engineer or Area Oil and Gas Supervisor of the Geological Survey. However, the Federal surface management agency will establish the rehabilitation requirements and will be available for consultation during rehabilitation

operations. Names, addresses, and phone numbers of appropriate personnel of the Geological Survey and the Federal surface management agency, as well as approved surface use areas, will be furnished the lessee or operator on its approved copy of the permit and surface use plan.

Lessees and operators, as well as their contractors and subcontractors, must not commence any operation or construction activity on a lease without the prior approval of the appropriate official of the Geological Survey. Likewise, the terms and conditions of an approved permit and surface use plan may not be altered unless the Geological Survey has approved an amended or supplemental permit and/or plan covering any such modifications. Approval of subsequent operations is addressed in Section V of this notice.

## II. Drilling Operations

### A. Preliminary Environmental Review

A preliminary environmental review will be required on all future drilling operations prior to entry on the ground for the purpose of staking the location, access roads, and other surface use areas. The lessee or operator, upon finalizing plans to drill but prior to the actual surveying, must file with the Geological Survey's District Engineer or Area Oil and Gas Supervisor and the appropriate office of the involved Federal surface management agency, a topographic map (or equivalent) of a scale not less than 1 inch=1 mile which shows the preferred location and the general topographic features in the area. This will permit the Federal surface management agency, prior to the lessee's or operator's expenditure of time and money for surveys, to review its records for any potential conflicts with other resource values. If conflicts are noted, a joint conference or field inspection, as appropriate, by the Geological Survey, the Federal surface management agency, and the operator may be scheduled to resolve problem areas.

### B. Application for Permit to Drill

All drilling operations must be conducted in accordance with a permit or development plan which has the prior approval of the District Engineer or Area Oil and Gas Supervisor.

The permit or development plan filed for approval will consist of the application for permit to drill on Form 9-331C, and a multi-point surface use and operations plan. Where private surface is involved, it should also include a copy of the written agreement between the lessee or operator and the surface owner or a letter setting forth the rehabilitation requirements of the surface owner. The requirements for surface use and operations plans and the rehabilitation of private surface are contained in Sections III and VI, respectively, of this notice.

The application for permit to drill must provide information concerning (1) the location in feet and direction from the nearest lines of an established survey, as determined by a registered surveyor or engineer; (2) the elevation above sea level of the ground and derrick floor or rotary kelly bushing; (3) the geologic name of the surface formation; (4) the type of tools and other equipment to be utilized; (5) the proposed drilling depth; (6) the estimated tops of important geologic markers; (7) the estimated depths at which water, oil, gas, or other mineral deposits are expected to be encountered; (8) the proposed casing program including the size, grade, weight, and safety factors for collapse, tension, and burst of each string; (9) the proposed setting depth of each casing string and the amount and type of cement (including additives) and mud to be used; (10) the proposed pressure control equipment which is to be used and a schematic diagram thereof; (11) the type and characteristics of the proposed drilling medium or mediums to be employed; (12) the testing, logging, and coring programs to be followed; (13) any abnormal pressures or temperatures expected to be encountered or potential hazards such as hydrogen sulfide gas and plans for mitigating such hazards; (14) the anticipated starting date and duration of the operation; and, (15) any other facets of the proposed operation which are pertinent to the Geological Survey's consideration of the application. The District Engineer or Area Oil and Gas Supervisor may require additional information as warranted.

A copy of approved application for permit to drill and the accompanying surface use and operations plan shall be posted at the drillsite.

## III. Multi-Point Surface Use and Operations Plan

A surface use and operations plan in sufficient detail to permit a complete appraisal of the environmental effects associated with the proposed project must be submitted, in triplicate, to the District Engineer or Area Oil and Gas Supervisor with the application for permit to drill.

The Geological Survey will send a copy of such plan to the Federal surface management agency. When possible, a preliminary field development plan or drilling schedule should also be submitted to allow lead time for evaluating environmental considerations, resource conflicts, and land use planning alternatives.

The plan shall in its context provide for and assure adequate protection of surface resources, other environmental components, and include adequate measures for reclamation of disturbed lands. The plan shall be developed in conformity with the provisions of the lease, attached stipulations, and the guidelines provided by this Notice. In developing the plan, the lessee or operator will make use of such information as is available from the Federal surface management agency concerning the surface resources, environmental considerations, and local reclamation procedures. The plan will be reviewed for adequatecy by the Geological Survey and the Federal surface management agency. Approval of proposed activities that would result in irreparable

or extensive damage to the environment will be withheld until the plan is modified, additional mitigating measures are provided, or alternatives to the proposed action are agreed upon.

### A. GUIDELINES FOR THE PREPARATION OF SURFACE USE AND OPERATIONS PLANS

In the preparation of surface use and operations plans, lessees and operators should adhere closely to the following:

1. *Existing roads.* A legible map (USGS topographic or county road map of a scale not less than 1 inch=1 mile) shall be used for locating the proposed well site in relation to a town or other locatable reference point. The proposed route to the location including appropriate distances from the reference point to the point where the access route exits the highway or county road shall be shown. All proposed access roads shall be appropriately labeled or color coded. Additionally, all existing roads within a radius of three miles from the location of a proposed exploratory well should be shown. An exploratory well is a well which is located two miles or more from the boundary of a known geologic structure or a producible well. For all other drillsites (development wells) existing roads within a one-mile radius of the location should be shown.

Any plans for the improvement and/or maintenance of existing roads should also be stated.

Information required by Item Nos. 3 and 4 of this subsection may also be shown on this map if appropriately labeled.

2. *Planned access roads.* Information in this regard is to be submitted on a large scale map (not less than 4 inches = 1 mile) and shall appropriately identify all permanent and temporary access roads that are to be constructed, or reconstructed in connection with the drilling and production of the proposed well. Width, maximum grade, turnouts, drainage design, location and size of culverts, and surfacing material, if any, shall be stated. At the time of submission, the location of all proposed new or reconstructed roads shall be staked. However, modification of proposed road design may be required after the location is accepted.

Information should also be furnished to indicate where existing fences will be cut and whether gates or cattleguards will be used. Additionally, the discussion should make reference to any existing gates which are to be replaced by cattleguards.

3. *Location of existing wells.* This information should be submitted on a map of suitable scale and include all wells (producing, abandoned, temporary abandoned, shut-in, injection, disposal, and drilling) within a two-mile radius of the proposed location of an exploratory well or within a one-mile radius of the proposed location of a development well.

4. *Lateral roads to well locations.* The information submitted in this regard should be shown on a map of suitable scale and include all existing and proposed lateral roads to all well locations within a one-mile radius of the proposed location.

5. *Location of tank batteries, production facilities, and production, gathering, and service lines.* Existing tank batteries, production facilities, and production, gathering, or service lines within a one-mile radius of the proposed location which are owned or controlled by the lessee or operator should be shown on a map or plat of suitable scale. The type of each present facility and the exact nature of each existing line (oil flowline, gas gathering line, injection line, or water disposal line) should be identified and it should be noted which, if any, of said lines are buried. If new facilities (tank battery, other production equipment, and lines) are contemplated in the event production is established and those facilities are to be located at other than on the well site itself, the map or plot furnished in this regard must also indicate the location all proposed new facilities. Future prospects for additional development of the leasehold should be considered in the siting of new facilities. However, final approval to construct such new facilities will not be granted until after detailed plans have been submitted and evaluated pursuant to Section V hereof.

6. *Location and type of water supply (rivers, creeks, lakes, ponds, and wells).* This information may be shown by quarter-quarter section on a plat or map of suitable scale or may be a written description. The source of all water to be used in drilling the proposed well should be noted. The method of transporting the water shall be stated and any access roads needed to haul the water will be described in Items Nos. 1 or 2, as appropriate. However, the Survey's approval of the surface use and operations plan does not relieve the lessee or operator from obtaining any other authorization which may be required for the use of such water. Moreover, if a water supply well is to be drilled on the lease, it must be so stated under this item and the District Engineer or Area Oil and Gas Supervisor may require the filing of a separate application for permit to drill.

7. *Source of construction materials.* This information may be shown by quarter-quarter section on a plat or map of suitable scale or may be a written description. The proposed source, character, and use of all construction materials such as sand, gravel, stone, and soil material should be stated. Any access roads needed to haul such materials should be described in Item Nos. 1 or 2, as appropriate.

8. *Methods for handling waste disposal.* A brief, written description should be given of the methods and location for safe containment and disposal of each type of waste material (cuttings, garbage, salts, chemicals, and sewage) which results from the drilling of the proposed well. Likewise, the narrative should include plans for the eventual disposal of drilling fluids and any produced oil or water recovered during testing operations.

9. *Ancillary facilities.* The plan or subsequent amendments to such plans shall identify all ancillary facilities such as camps and airstrips as to their location, land area required, and the methods and standards to be employed in their construction. Such facilities shall be shown on a map of suitable scale and shall be staked on the ground.

10. *Well site layout.* A plat of suitable scale (not less than 1 inch=50 feet) including cross section diagrams of the drill pad and the relation to topography are required. The plat should also include the proposed location of the mud tanks, pits (reserve, burn, and trash), pipe racks, access road, turnaround areas, parking areas, living facilities, soil material stockpile, and the orientation of the rig with respect to the pad and other facilities. Plans to line the reserve pit should be indicated.

The exterior dimensions of the pad and reserve pit shall be specified and will be staked on the ground.

11. *Plans for restoration of the surface.* State the proposed program for surface restoration upon completion of the operation such as stockpiling topsoil, leveling, reseeding, and seed mixture. Such plans will be reviewed for adequacy by the appropriate Federal surface management agency. A proposed timetable for the commencement and completion of rehabilitation operations must be provided.

12. *Other information.* Include a general description of the topography, soil characteristics, formation lithologies, geologic features, flora, fauna, and other aspects of the area such as other surface use activities.

The surface ownership (Federal, Indian, State, or private) at the well location and for all lands which are to be crossed by newly constructed roads should be indicated.

Any available information which would be useful in evaluating the environmental impact of the proposed operation, including proximity to steep hillsides and gullies, water wells, ponds, lakes, or streams, occupied dwellings, or other facilities, and archeological, historical, or cultural sites should be included. Information concerning required cuts and fills during the construction of roads and the location should also be furnished.

All construction practices necessary to accommodate potential geologic hazards should be discussed under the appropriate items of the plan.

13. *Lessee's or operator's representative.* Include the name, address, and phone number of the lessee's or operator's field representative who is responsible for assuring compliance with the approved surface use and operations plan.

14. *Certification.* The following statement is to be incorporated in the plan and must be signed by the lessee's or operator's field representative who is identified in item No. 13 of the plan:

I hereby certify that I, or persons under my direct supervision, have inspected the proposed drillsite and access route; that I am familiar with the conditions which presently exist; that the statements made in this plan are, to the best of my knowledge, true and correct; and, that the work associated with the operations proposed herein will be performed by ——————— and its contractors subcontractors in conformity with this plan and the terms and conditions under which it is approved.

———————
Date

———————
Name and Title

## IV. Environmental Analysis Requirements

When an application for permit to drill is received, an onsite inspection normally will be required. If made, it will include the District Engineer or Area Oil and Gas Supervisor, the lessee or operator, the Federal surface management agency, and others including the dirt contractor, as appropriate. The purpose of tihs inspection will be to select the most feasible and environmentally acceptable areas for well sites (considering geologic factors and Federal and State regulations), access roads and other proposed surface use areas. Accordingly, lessees and operators are encouraged to designate future development or drilling sites so that several locations may be inspected at one time.

When such an inspection is made, an environmental analysis will usually be prepared by the District Engineer or Area Oil and Gas Supervisor. Said analysis will identify methods for mitigating the potential adverse environmental effects associated with the proposed operation and will be the basis of the approving official's determination as to whether approval of the proposed activity would constitute a major Federal action significantly affecting the quality of the human environment as defined by Section 102(2)(C) of the National Environmental Policy Act of 1969. Any surface protection and rehabilitation requirements specified by the Federal surface management agency will normally be made a part of any subsequently approved permit or and/or the surface use and operations plan.

Due to the probability of a required onsite inspection, the required input from other Federal agencies, and the variations in the level of drilling activity, lessees and operators are encouraged to file applications well in advance of the time when it is desired to commence operations.

## V. Approval of Subsequent Operations

Before repairing, deepening, or conditioning a well, a detailed written statement of the plan of work must be filed on Form 9–331 or 9–331C with the District Engineer or Area Oil and Gas Supervisor and approval obtained before the work is started. Any proposed change in any such plan of work must also receive the prior approval of the District Engineer or Area Oil and Gas Supervisor.

Lessees and operators are also required to submit for the approval of the District Engineer or Area Oil and Gas Supervisor

a suitable plan prior to undertaking any subsequent new construction, reconstruction, or alteration of existing facilities, including roads, dams, lines or other production facilities on any lease when additional surface disturbance will result. Sufficient information must be submitted to permit a proper evaluation of the proposed surface disturbing activities as well as any planned accommodations necessary to mitigate potential adverse environmental effects.

The environmental analysis procedures discussed in Section IV of this Notice will also apply to such subsequent operations which have the potential for significant surface disturbance although these requirements may be somewhat less in established producing areas.

### VI. Agreement for Rehabilitation of Privately-Owned Surface

Where the surface is privately owned or is owned by an Indian allottee, each application for permit to drill or to conduct other surface disturbance activities, shall contain information concerning the surface owner's rehabilitation requirements. A written agreement between the lessee or operator and the surface owner is not necessary if a letter from the lessee or the operator setting forth the surface owner's rehabilitation requirements is furnished. Payment of damages in lieu of full restoration will not be an acceptable substitute for a normal cleanup and rehabilitation program.

If no arrangements have been made, or if information concerning such arrangements is not furnished, the District Engineer or Area Oil and Gas Supervisor will request the Federal surface management agency to recommend the necessary surface restoration requirements. In such cases, the lessee or operator will be expected to comply with these rehabilitation requirements, if any, regardless of the arrangement made with the surface owner. Provided, however, that subsequent reasonable requests by the surface owner that pits, roads, and other facilities be left intact may be honored. If written proof of prior arrangements has been provided, the Federal surface management agency will be asked to recommend surface rehabilitation requirements to the District Engineer or Area Oil and Gas Supervisor giving full consideration to the preferences of the landowner.

### VI. Well Abandonment

No well abandonment operations may be commenced in the absence of the prior approval of the District Engineer or Area Oil and Gas Supervisor. However, the Federal surface management agency may request additional surface rehabilitation measures at abandonment and these requirements are normally made a part of the Geological Survey's approval of abandonment. Upon completion of the abandonment and rehabilitation operations, the lessee or operator should notify the District Engineer or Area Oil and Gas Supervisor that the location is ready for inspection. However, final abandonment will not be approved until the surface rehabilitation work required by the drilling permit or abandonment notice has been completed and the required vegetation is established to the satisfaction of the appropriate Federal surface management agency.

### VII. Water Well Conversion

The complete abandonment of a well which has encountered usable fresh water will not be approved if the Federal surface management agency determines it wants to acquire the well. If, at abandonment, the Federal surface management agency elects to assume further responsibility for the well, it will reimburse the lessee or operator for the cost of any recoverable casing left in the hole solely because it is to be completed as a water well. The lessee or operator will abandon the well to the base of the deepest fresh water zone of interest as required by the District Engineer or Area Oil and Gas Supervisor and will complete the surface cleanup and rehabilitation as required by the drilling permit or abandonment notice immediately upon completion of the conversion operations.

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facility for noncompliance. Adds authority for the District Engineer to require modification of facilities prior to October 1, 1977, when warranted. Changes data requirements for applications from general to specific under each category. Provides that previous applications not meeting the requirements of this Notice must be refiled or supplemented and for the filing of a single application for multiple facilities.

*Disposal in subsurface.* Adds injection wells in pressure maintenance projects; a specific project description; quantity, source, and analysis data for produced water; indigenous water data; a bond log in some cases; a contingency plan in the event of a system failure; and, a general provision that injection may be approved in zones containing unusable water even though it is of better quality than the produced water.

*Disposal in line pits.* Adds a map requirement; data about quantity and source of produced water; and, a contingency plan in the event of a system failure.

*Disposal in unlined pits.* Deletes the reference to total pounds of dissolved solids. Adds a provision for disposing of water where the indigenous water is not unsable even though it is of better quality than the produced water; analysis data for produced water; a map requirement; indigenous water data; State permits granted as a result of public hearings; and a fencing requirement. The Notice also provides that pits will be located away from drainage and clarifies the submittal of data regarding percolation rate.

*Temporary use of surface pits.* Adds a provision that fluids contained in such pits may not be drained on the surface of the land at clean-up without prior approval and a fencing requirement.

*Disposal facilities for new wells.* Provides for 90 days temporary use instead of 30 and for 60 days in which to correct the disposal method unless District Engineer determines a danger to the environment.

*Unavoidable delay.* Provides for a six-month extension in arctic and subarctic areas.

*Reports.* Provides that no annual water analysis will be required when the volume is less than five barrels per day; for the submittal of the latest monitoring report in lieu of annual reports where a NPDES permit is in effect; and, for single annual report for multiple facilities which have been approved by a single application.

*Compliance.* Adds Safe Drinking Water Act regulations to this provision.

NOTE: It is hereby certified that the economic impacts of Notice to Lessees and Operators, NTL–2B, have been carefully evaluated in accordance with OMB Circular A–107.

W. H. RADLINSKI,
*Acting Director.*

[NTL–2B]

DISPOSAL OF PRODUCED WATER

NOTICE TO LESSEES AND OPERATORS OF FEDERAL AND INDIAN OIL AND GAS LEASES

This notice supersedes NTL–2 and 2A and is issued pursuant to the authority prescribed

## Geological Survey

## DISPOSAL OF PRODUCED WATER

### Lessees and Operators of Federal and Indian Oil and Gas Leases

On August 15, 1975, the Geological Survey published in the FEDERAL REGISTER (Vol. 40, No. 93, pp. 34425–34427), a proposed notice which prescribed the requirements applying to the disposal of water produced from wells on Federal and Indiaan oil and gas leases and those on fee and State leases committed to federally approved cooperative agreements.

Written and oral comments, suggestions, and objections received by the Geological Survey have been carefully considered in the preparation of the final Notice to Lessees and Operators, NTL–2B. All written comments are on file with the Geological Survey. Certain of these comments have been incorporated or essentially satisfied and the Geological Survey has made other changes on its own motion. The principal changes are discussed below:

*Definition.* The approval authority of the Geological Survey is better defined.

*Disposal requirements and application.* Provides that approval must be obtained regardless of the physical location of the disposal facility. Also warns that applications for approval of existing facilities filed after July 1, 1977, may not be approved in time to prevent the shut-in

in 30 CFR 221.4 and 221.32. Lessees and operators of onshore Federal and Indian oil and gas leases or fee and State leases committed to federally supervised unitized or communitized areas shall comply with the following requirements for the handling, storing, or disposing of water produced from oil and gas wells on such leases.

As used in this notice, the term "District Engineer" means the District Engineer, U.S. Geological Survey. However, in the State of Alaska, the requirements of this Notice will be administered by the Area Oil and Gas Supervisor.

*I. Disposal requirements and applications for approval of disposal methods.* By October 1, 1977, all produced water from the above said leases must be disposed of by (1) injection into the subsurface; (2) lined pits; or, (3) by other acceptable methods. All such disposal method must be approved in writing by the District Engineer regardless of the physical location of the disposal facility. Any method of disposal which has not been approved as of October 1, 1977, will be considered as an incident of noncompliance and will be grounds for issuing a shut-in order until an acceptable manner for disposing of said water is provided and approved by the District Engineer. Lessees and operators are encouraged to file applications in this regard as promptly as possible and are forewarned that applications for approval of existing disposal facilities which are filed after July 1, 1977, may not be timely approved.

No additional approval is required for facilities previously approved by the Geological Survey which involve the disposal of produced water into the subsurface or in lined surface pits. Likewise, no further approval is necessary for existing injection facilities utilized for pressure maintenance or secondary recovery operations.

Lesses and operators who are presently disposing of water in unlined surface pits must timely file applications with the District Engineer for approval of present or proposed disposal methods. Likewise, lessees and operators who are presently disposing of produced water in the subsurface or in lined surface pits without approval of the Geological Survey must also file applications for approval thereof by the District Engineer.

The District Engineer may require modification of any disposal facility prior to October 1, 1977, whenever it is determined that continued use of such facility is endangering the fresh water in the area or is otherwise adversely affecting the environment.

Any application to dispose of produced water must specify the proposed method of disposal and provide the information necessary to justify the method. Required information which must be included in applications for approval of produced water disposal in the subsurface, in lined pits, or in unlined pits is set forth in sections II, III, and IV, respectively, of this notice. Additional information may be required by the District Engineer in individual cases. Previous applications filed in response to NTL–2 and NTL–2A which do not met the data requirements of this Notice must be supplemented or resubmitted.

A single application may be submitted for several leases or facilities: *Provided*, That (1) the leases or facilities are located in the same field; (2) the produced water is from the same formation or is of similar quality; (3) the volume and source of the water is shown separately for each disposal facility; and, (4) the method of disposal is the same in every case.

II. *Disposal in the subsurface.* If approval is requested for subsurface water injection in connection with secondary recovery operations or for disposal purposes, the lessee or operator must furnish information which includes:

1. The designated name and number of the proposed disposal well and its location in feet and direction from the nearest section lines of an established survey. The applicable Federal or Indian oil and gas lease number or other permit and/or the ownership of the surface and minerals if other than Federal or Indian.

2. The daily quantity and sources of the produced water and a water analysis which includes total dissolved solids, pH, and the concentrations of chlorides and sulfates.

3. The injection formation and interval.

4. The quality of the fluids in the injection interval, i.e., total dissolved solids.

5. The depth and areal extent of all usable water (i.e., less than 10,000 ppm total dissolved solids) aquifers in the area.

6. The size, weight, grade and casing points of all casing strings, the size hole drilled to accommodate each string, the amount and type of cement, including additives used in cementing each string, and the top of the cement behind each casing string. In addition, bond logs may be required in certain instances.

7. The total and plugged back depth of the well.

8. The present or proposed method of completing the well for injection including the type and size of tubing and packer to be utilized, the setting depth of the packer, anticipated injection pressure, and information concerning any corrosion inhibitor fluid which is to be placed in the tubing-casing annulus.

9. Plans for monitoring the system to assure that injection is confined to the injection interval and measures, to be taken should it be necessary to shut-in the disposal system.

In order to be approved, subsurface disposal must be confined (1) to formations which contain water of similar or poorer quality than the injected water or (2) to formations that contain water of such poor quality as to eliminate any practical use thereof.

In general, it will be required that subsurface disposal be accomplished through tubing utilizing a packer which is designed to hold pressure from above and below. The packer should be set at a depth where the casing is protected by competent cement but normally not more than 50 feet above the injection interval. Other procedures or methods of subsurface disposal may be approved by the District Engineer when justified by the lessee or operator.

III. *Disposal in lined pits.* Where approval is requested for surface disposal in a lined pit, the lessee or operator must supply information which includes:

1. A topographic map of suitable scale which shows the size and location of pit.

2. The daily quantity, sources of the produced water, and a water analysis which includes the concentrations of chlorides, sulfates, and other constituents which are toxic to animal, plant, or aquatic life.

3. The evaporation rate for the area compensated for annual rainfall.

4. The method for periodic disposal of precipitated solids.

5. The type of material to be used for lining the pit and the method of installation.

6. The method to be employed for the detection of leaks and plans for corrective action should a leak occur in the liner.

The material used in lining pits must be imperivious, weather-resistant, and not subject to deterioration when contacted by hydrocarbons, aqueous acids, alkalies, fungi, or other substances likely to be contained in the produced water. Lined pits constructed after the issuance of this Notice must have an underlying gravel-filled sump and lateral

system or other suitable devices for the detection of leaks. The District Engineer shall be provided an opportunity to inspect the leak detection system prior to the installation of the pit liner.

IV. *Disposal in unlined pits.* Surface disposal into unlined pits will not be considered for approval by the District Engineer unless the lessee or operator can show by application that such disposal meets any one or more of the following criteria:

1. The water to be disposed of has an annual weighted average concentration of not more than 5,000 ppm of total dissolved solids: *Provided,* That such water does not contain objectionable levels of any constituent toxic to animal, plant, or aquatic life.

2. That all, or a substantial part, of the produced water is being used for beneficial purposes. For example, produced water used for purposes such as irrigation and livestock or wildlife watering shall be considered as being beneficially used.

3. The water to be disposed of is not of poorer quality than the surface or subsurface waters in the area which reasonably might be affected by such disposal or the surface and subsurface waters are of such poor quality as to eliminate any practical use thereof.

4. The volume of water to be disposed of per facility does not exceed five barrels per day on a monthly basis.

5. The specific method of disposal has been granted a surface discharge permit under the National Pollutant Discharge Elimination System (NPDES).

Applications for approval of unlined surface pits pursuant to exception Nos. 1, 2, 3, or 4, above, must include:

1. The daily quantity and sources of the produced water and for exception Nos. 1 through 3, a water analysis which includes total dissolved solids, pH, and the concentrations of chlorides and sulfates.

2. A topographic map of suitable scale which shows the size and location of the pit.

3. The evaporation rate for the area compensated for annual rainfall.

4. The estimated percolation rate based on the soil characteristics under and adjacent to the pit.

5. The depth and areal extent of all usable water (i.e., less than 10,000 ppm total dissolved solids) aquifers in the area.

Where beneficial use is the basis for the application, the justification submitted must contain written confirmation from the user(s) and the water analysis must also include the oil and grease content, temperature, and the concentration of other constituents which are toxic to animal, plant, or aquatic life.

If the application is made on the basis that surface and subsurface fresh waters will not be affected by disposal in an unlined pit, the justification must also include:

1. Analyses of all surface and subsurface waters in the area which might reasonably be affected by the proposed disposal.

2. Maps or plats showing the location of surface waters, fresh water wells, and existing water disposal facilities within two miles of the proposed disposal facility.

3. Reasonable geologic and hydrologic evidence showing that the proposed disposal method will not adversely impact on existing water quality or major uses of such waters; the depth of the shallowest fresh water aquifer in the area and the presence of any impermeable barrier(s).

4. A copy of any State order or other authorization granted as a result of a public hearing which is pertinent to the District Engineer's consideration of the application.

If the application is for disposal pursuant to an NPDES permit, only a topographic map showing the size and location of the pit together with a copy of the approved permit and the most recent "Discharge Monitoring Report" will be required.

V. *General requirements for permanent surface pits.* Lined and unlined pits approved for water disposal shall:

1. Have adequate storage capacity to safely contain all produced water even in those months when evaporation rates are at a minimum.

2. Be constructed, maintained, and operated to prevent unauthorized surface discharges of water. Unless surface discharge is authorized, no siphon, except between pits, will be permitted.

3. Be fenced to prevent livestock or wildlife entry to the pit, when required by the District Engineer.

4. Be kept reasonably free from surface accumulations of liquid hydrocarbons by use of approved skimmer pits, settling tanks, or other suitable equipment.

5. Be located away from the established drainage patterns in the area and be constructed so as to prevent the entrance of surface water.

VI. *Temporary use of surface pits.* Unlined surface pits may be used for handling or storage of fluids used in drilling, redrilling, reworking, deepening, or plugging of a well provided that such facilities are promptly and properly emptied and restored upon completion of the operations. Mud or other fluids contained in such pits shall not be disposed of by cutting the pit walls without the prior authorization of the District Engineer. Until finally restored, unattended pits must be fenced to prevent access by livestock and wildlife. Unless otherwise specified by the District Engineer, unlined pits may be used for well evaluation purposes for a period of 30 days.

Unlined pits may also be retained as temporary containment pits for use only in an emergency provided such pits have been approved by the District Engineer. Any emergency use of such pits shall be reported to the District Engineer as soon as possible and the pit shall be emptied and the liquids disposed of in an approved manner within 48 hours following its use, unless such time is extended by the District Engineer.

VII. *Disposal facilities for new wells.* With the approval of the District Engineer, produced water from wells completed after the issuance date of this Notice may be temporarily disposed of into unlined pits for a period up to 90 days. During the period so authorized, an application for approval of the permanent disposal method, along with the required water analysis and other information, must be submitted to the District Engineer. Failure to timely file an application within the time allowed will be considered an incident of noncompliance and will be grounds for issuing a shut-in order until the application is submitted. With the approval of the District Engineer, the disposal method may be continued pending his final determination. Once the District Engineer has determined the proper method of disposal, the lessee or operator will have until October 1, 1977, or 60 days following receipt of the District Engineer's determination, whichever is the longer, in which to make any changes necessary to bring the disposal method into compliance. However, if the disposal method then employed is endangering the fresh water in the area or otherwise constitutes a hazard to the quality of the environment, the District Engineer will direct prompt compliance with the requirements of this Notice.

VIII. *Unavoidable delay.* A single extension of time not to exceed three months (six months in arctic and subarctic areas) may be granted by the District Engineer where the lessee or operator conclusively shows by

application that, despite the exercise of due care and diligence, he has been unable to timely comply with the requirements of the notice: *Provided*, That such delay will not adversely affect the environment.

IX. *Reports*. All unauthorized discharges or spills from disposal facilities must be reported to the District Engineer in accordance with the provisions of NTL–3.

Beginning October 1, 1978, and thereafter on an annual basis, lessees and operators must submit a report for each facility which includes the total volume disposed of during the reporting period and a current water analysis which provides the same type of information required for approval of the original application: *Provided however*, That:

1. Where disposal is approved pursuant to section IV (4), no annual water analysis will be required.

2. Where disposal is approved pursuant to a NPDES permit, a copy of the required discharge monitoring report may be submitted in lieu of the above annual report.

3. Where a single application was approved for several leases and/or facilities, a composite annual report covering all such leases and facilities may be submitted.

X. *Compliance*. Compliance with this notice does not relieve a lessee or operator of the responsibility for complying with more stringent applicable Federal or State water quality laws and regulations, including those which are subsequently promulgated pursuant to the Safe Drinking Water Act (Pub. L. 93–523), or with other written orders of the Geological Survey.

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Date

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Area Oil and Gas Supervisor

Approved:

RUSSELL G. WAYLAND,
*Chief, Conservation Division.*

[FR Doc.75–33432 Filed 12–11–75;8:45 am]

# DRILLING MUD MATERIALS

| FUNCTION | MATERIALS | WHY USED |
|---|---|---|
| Lubricants | Certain oils, graphite powder and soaps. | To reduce down-hole friction. |
| Flocculants | Salt, Hydrated lime, Gypsum and Sodium Tetraphosphates. | To increase gel strength. Causes some solids to settle out. |
| Filtrate Reducers | Bentonite clays, Sodium carboxy-methyl cellulose (CMC) and pregelatinized starch. | Reduce filter loss. Prevent "water loss" to porous formations |
| Foaming Agents | Anionic foaming chemicals. | Causes formation water to foam helping gas or air drilling to continue. |
| Lost Circulation | Asphalt Emulsions, Asbestos Fibers, Shredded Plastics, Mica Flakes, Nut Hulls, Cedar Fibers, Cottonseed Hulls and many other materials. | To stop mud loss to porous zones. |
| Shale Control Inhibitors | Gypsum, Sodium Silicate, Chrome Lignosulfates, Lime and salt. | To stop or prevent swelling of shales or clays. |
| Surface Active Agents | Surfactant Chemicals | To permit better mixing. Example-water and oil. |
| Thinners and Dispersants | Quebracho, some Polyphosphates and lignitic materials. | To prevent too high a viscosity, improve pumpability, better solids distribution in muds. |
| Viscosifiers | Bentonite, CMC, Attapulgite clays and Asbestos Fibers. | To increase fiscosity for cuttings removal and gel strength. |
| Preservatives | Formaldehyde | Prevent starch mud from fermenting. |

| FUNCTION | MATERIALS | WHY USED |
|---|---|---|
| Cement Contamination | Sodium Bicarbonate | Prevents mud destruction. |
| Calcium Removers | Caustic Soda, Soda Ash, Certain Poly-phosphates (SAPP) and Sodium Bicarbonate. | To prevent mud destruction by Gypsum or Anhydrite. |
| Weight Materials | Barite, Lead Compounds, Iron Oxides and high specific gravity compounds. | To increase mud weight (pounds per gallon) to hold formation fluids in place and prevent hole caving. |
| Corrosion Inhibitors | Hydrated Lime, Amine Salts and Dichromate salts. | To prevent corrosion of drilling equip-ment and casing. |
| Oil Emulsion | Special Emulsifiers or Soaps. | To make oil-in-water or water-in-oil emulsions for "oil base" mud. |

Sources:

American Association of Oilwell Drilling Contractors. Toolpusher's Manual, Section O. September 1970.

Gatlin, Carl. Petroleum Engineering, "Drilling and Well Completions," Chapter 6. Prentice-Hall, Inc. New York. 1960.

# MODELS OF SURFACE USE REQUIREMENTS OF OIL PRODUCTION ON 20-ACRE TO 640-ACRE PER WELL SPACING PATTERNS

The models show land required for roads, well sites, flowlines, tank batteries and waste water disposal facilities for leases containing 10 producing wells.

## 20-, 40- and 80-Acre Per Well Spacing Patterns

Figure I-C-1 shows a possible road, flowline, tank battery and water disposal layout for a 960-acre lease with 10 producing wells established on an 80-acre per well spacing pattern (Model "C"). One of the dry or depleted holes is used for waste water injection. The layouts of Models "A" and "B" are similar in concept. Three combinations of well spacing patterns and lease sizes are included.

D = Acres used during development phase
P = Acres used during production phase

| | Model A | Model B | Model C |
|---|---|---|---|
| Acres in lease | 240 | 480 | 960 |
| Acres per well (well spacing) | 20 | 40 | 80 |
| Number of producing wells | 10 | 10 | 10 |
| Number of dry holes | 2 | 2 | 2 |
| Number of disposal wells (converted dry holes) | 1 | 1 | 1 |

### Land Requirements

| | Model A | | Model B | | Model C | |
|---|---|---|---|---|---|---|
| | D | P | D | P | D | P |
| 1. Acres Per Well | | | | | | |
| a. Roads | 0.28 | 0.55 | 0.33 | 0.65 | 0.50 | 1.00 |
| b. Well sites | .75 | 0.01 | 1.00 | 0.01 | 1.00 | 0.01 |
| c. Flowlines | 0.25 | 0 | 0.30 | 0 | 0.50 | 0 |
| Total Per Well | 1.28 | 0.56 | 1.63 | 0.66 | 2.00 | 1.01 |
| 2. Acres Per Lease | | | | | | |
| a. Tank battery | 0 | 0.35 | 0 | 0.35 | 0 | 0.35 |
| b. Office and storage | 0 | 1.00 | 0 | 1.00 | 0 | 1.00 |
| c. Water-yard-disposal | 0 | 0.50 | 0 | 0.50 | 0 | 0.50 |
| Total Per Lease | 0 | 1.85 | 0 | 1.85 | 0 | 1.85 |

| | Model A | | Model B | | Model C | |
|---|---|---|---|---|---|---|
| | D | P | D | P | D | P |
| 3. Total Acres | | | | | | |
| a. Well acres | 12.80 | 5.60 | 16.30 | 6.60 | 20.00 | 10.10 |
| b. Dry holes-disposal well | 2.06 | 0.56 | 2.66 | 0.66 | 3.00 | 1.01 |
| c. Other lease areas | 0 | 1.85 | 0 | 1.85 | 0 | 1.85 |
| Total Acres | 14.86 | 8.01 | 18.96 | 9.11 | 23.00 | 12.96 |
| 4. Percent of Lease Area Used | 6.2 | 3.3 | 3.9 | 1.9 | 2.4 | 1.4 |
| 5. Acres Used Per Well | 1.2 | 0.7 | 1.6 | 0.8 | 1.9 | 1.2 |
| 6. Acres Used Per Sq. Mile | 38.4 | 22.4 | 25.6 | 12.8 | 15.2 | 9.6 |

## 160-, 320- and 640-Acre Per Well Spacing Patterns

Well spacing patterns for deep-well fields may range from 160 to 640 acres per well. Figure I-C-2 shows well locations commonly used for 160-, 320-, and 640-acre per well spacing patterns. Figure I-C-3 shows a possible well, road, flowline and storage tank layout for a 160-acre per well spacing pattern.

| | Model D | Model E | Model F |
|---|---|---|---|
| Acres in lease | 1,600 | 2,560* | 2,560* |
| Acres per well (well spacing) | 160 | 320 | 640 |
| Number of producing wells | 10 | 7 | 3 |
| Number of dry holes | 2 | 1 | 1 |
| Number of disposal wells (converted dry holes) | 1 | 1 | 1 |

*Maximum allowable acreage 2,560

| | Model D | | Model E | | Model F | |
|---|---|---|---|---|---|---|
| | D | P | D | P | D | P |
| 1. Acres Per Well | | | | | | |
| a. Roads | 2.00 | 4.00 | 1.50 | 3.00 | 1.00 | 2.00 |
| b. Well Sites | 2.00 | 0.01 | 3.00 | 0.01 | 4.00 | 0.01 |
| c. Flowlines | 1.00 | 0 | 1.00 | 0 | 1.00 | 0 |
| Total Per Well | 5.00 | 4.01 | 5.50 | 3.01 | 6.00 | 2.01 |
| 2. Acres Per Lease | | | | | | |
| a. Tank battery | 0 | 0.35 | 0 | 0.35 | 0 | 0.35 |
| b. Office and storage | 0 | 1.00 | 0 | 1.00 | 0 | 1.00 |
| c. Water-yard-disposal | 0 | 0.50 | 0 | 0.50 | 0 | 0.50 |
| Total Per Lease | 0 | 1.85 | 0 | 1.85 | 0 | 1.85 |

| | Model D | | Model E | | Model F | |
|---|---|---|---|---|---|---|
| | D | P | D | P | D | P |
| 3. Total Acres | | | | | | |
| a. Well acres | 50.00 | 40.10 | 38.50 | 21.07 | 18.00 | 6.03 |
| b. Dry holes-disposal well | 8.00 | 4.01 | 4.50 | 3.01 | 5.00 | 2.01 |
| c. Other lease areas | 0 | 1.85 | 0 | 1.85 | 0 | 1.85 |
| Total Acres | 58.00 | 45.96 | 43.00 | 25.93 | 23.00 | 9.89 |
| 4. Percent of Lease Area Used | 3.6 | 2.9 | 1.7 | 1.0 | 0.9 | 0.4 |
| 5. Acres Used Per Well | 4.8 | 4.2 | 5.4 | 3.2 | 5.7 | 2.4 |
| 6. Acres Used Per Sq. Mile | 19.2 | 16.8 | 10.8 | 6.4 | 5.7 | 2.4 |

ASSUMPTIONS

1. Roads: Development--9 feet wide; production--18 feet wide.
2. Wells: Drilling--3/4 to 4 acres per location; producing or injection--21 feet by 21 feet location.
3. Flowline: Ditches 54 inches deep by 16 inches wide; temporary surface disturbance 4 feet on each side of centerline during construction.
4. Tank battery, etc.: Includes 3 tanks for production, 1 tank for testing, 2 separators, 1 heater-treater, 1 gas flare line and 1 tank vent.
5. Water disposal: 1 dry hole converted to a water disposal well.

The areas shown in the models are adequate for most field operations. The amount of ground used in actual operations may be greater in some areas and less in others. An example is a 1,500-2,000 foot gas well drilled in northern Montana. The spacing is one well per section. The area needed to drill this well is approximately 50 feet by 50 feet as a truck-mounted drilling rig is used to drill the well. If the location is reasonably flat there is no removal of the vegetation, just damage from driving across the vegetation.

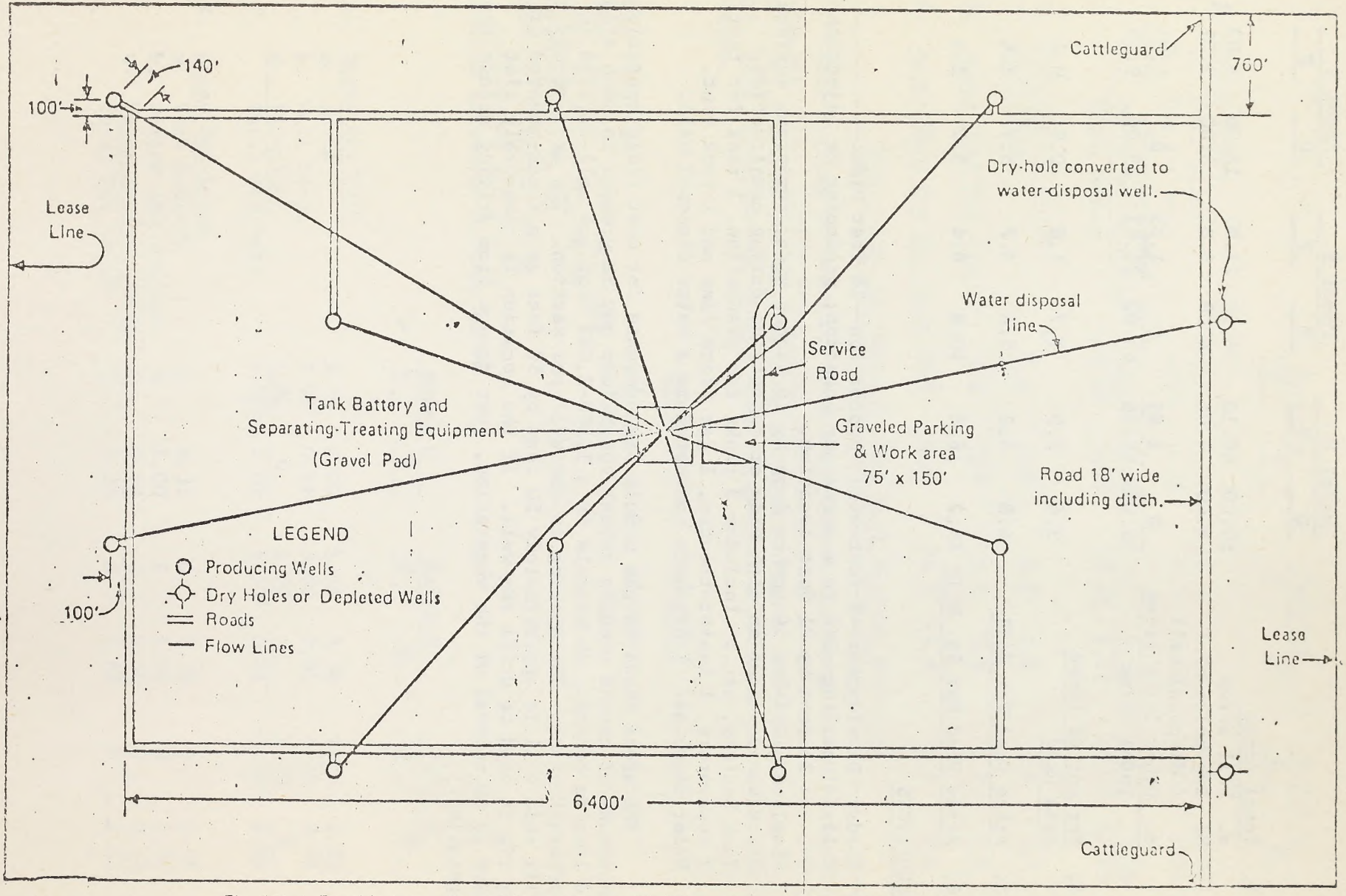
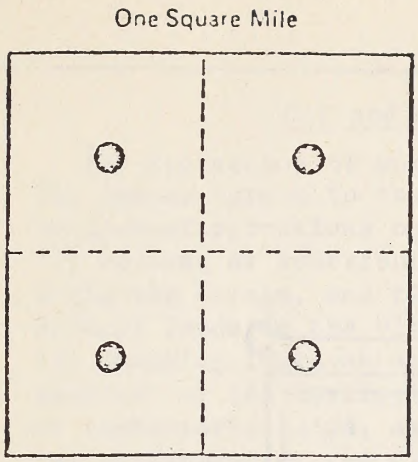
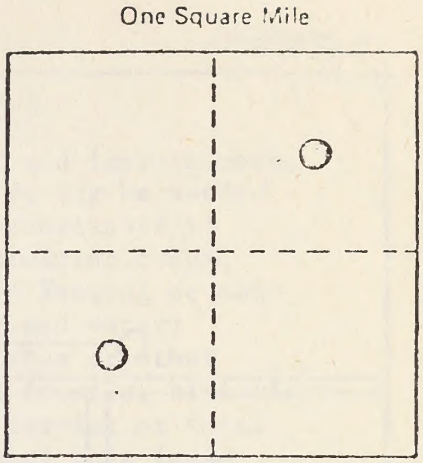


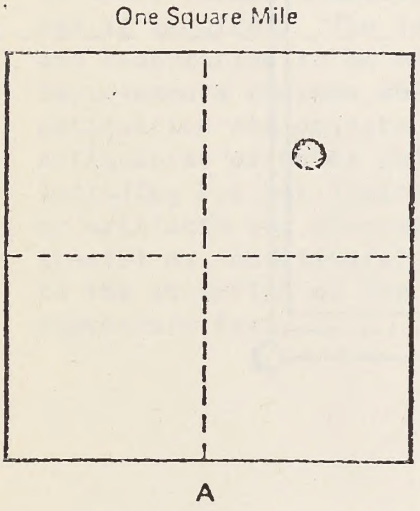

Fig. 1-C-1. Possible layout for a 960-acre lease with 10 producing wells established on an 80-acre per well spacing pattern

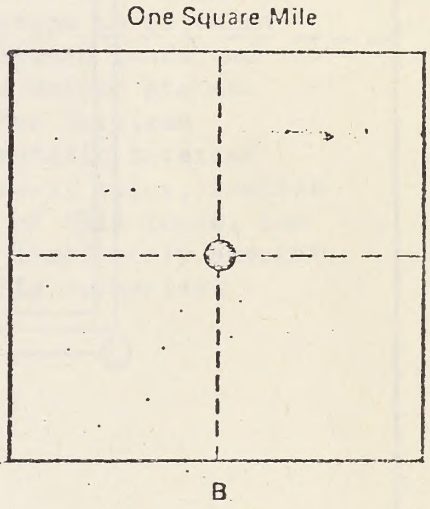



Well locations in a 160-acre per well spacing pattern.




Well locations in a 320-acre per well spacing pattern.




Alternative well locations for 640-acre per well spacing pattern. If 160-acre or 320-acre well spacing patterns are adopted at a later time to provide for additional petroleum recovery, pattern "A" will permit additional wells to be drilled in the section; pattern "B" will not.

Figure 1-C-2. Well locations commonly used for 160-acre, 320-acre and 640-acre per well spacing patterns

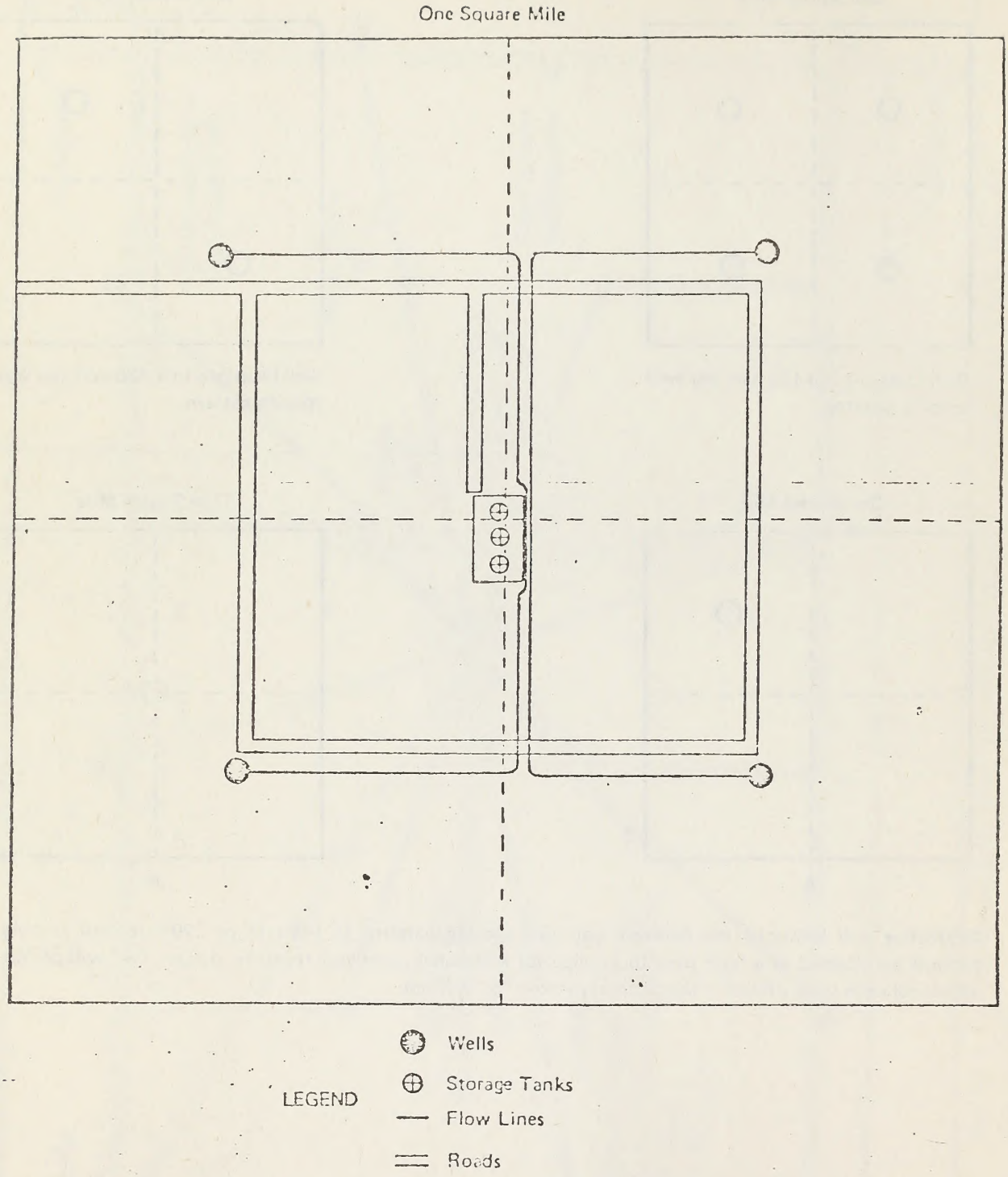



Figure 1-C-3. Possible layout for wells, roads, flow lines and storage tanks for a 160-acre per well spacing pattern

Oil and Gas Lease Form - BLM 3120-7

(q) Protection of surface, natural resources, and improvements. The lessee agrees to take such reasonable steps as may be needed to prevent operations on the leased lands from unnecessarily: (1) causing or contributing to soil erosion or damaging crops, including forage, and timber growth thereon or on Federal or non-Federal lands in the vicinity; (2) polluting air and water; (3) damaging improvements owned by the United States or other parties; or (4) destroying, damaging or removing fossils, historic or prehistoric ruins, or artifacts and upon any partial or total relinquishment or the cancellation or expiration of this lease, or at any other time prior thereto when required and to the extent deemed necessary by the lessor to fill any pits, ditches and other excavations, remove or cover all debris, and so far as reasonably possible, restore the surface of the leased land and access roads to their former condition, including the removal of structures as and if required. The lessor may prescribe the steps to be taken and restoration to be made with respect to the leased lands and improvements thereon whether or not owned by the United States. Antiquities and objects of historic value. -- When American antiquities or other objects of historic or scientific interest including but not limited to historic or prehistoric ruins, fossils or artifacts are discovered in the performances of this lease, the item(s) or condition(s) will be left intact and immediately brought to the attention of the contracting officer or his authorized representative.

# CULTURAL RESOURCE STIPULATIONS TO OIL AND GAS LEASES ISSUED IN OREGON

Prior to any operations under this lease, the Lessee will engage a qualified professional, acceptable to the Authorized Officer, to make a survey of the land to be disturbed or occupied. A certified statement, signed by the qualified professional, setting out the steps taken in the survey and the findings thereof as to the existence of antiquites or other objects of historic or scientific interest, shall be submitted to the Authorized Officer. If the statement indicates the existence of such materials which might be disturbed by operations under this lease, the Lessee shall take such mitigating actions as may be required by the Authorized Officer, including, but not limited to, archeological salvage or protective measures or avoidance of the site, to protect and preserve such objects. Such objects shall remain the property of the Lessor, or the surface owner if other than the Lessor.

If a cultural resource is discovered during project operations, activities will be stopped until a survey of the materials is completed by a professional engaged by the lessee and acceptable to the Authorized Officer, including but not limited to archeological salvage or protective measures or avoidance of the site, to protect and preserve the materials. Such materials shall remain the property of the Lessor, or the surface owner if other than the Lessor.

State of Oregon
DEPARTMENT OF ENVIRONMENTAL QUALITY

INTEROFFICE MEMO

To: Mr. R. E. Corcoran, State Geologist
Department of Geology and Mineral Industries

Date: September 2, 1975

From: Mr. Loren Kramer, Director
Department of Environmental Quality

Subject: SPECIAL CONDITIONS TO APPLY TO ALL DEEP WELL EXPLORATORY DRILLING IN OREGON

1. If a geothermal, mineral or petroleum resource of commercial interest is discovered, no drilling of additional wells or operations in connection therewith shall commence until an Environmental Impact Statement has been prepared for utilizing and developing the resource.

2. Prior to commencement of any drilling activities where drilling depth is expected to be in excess of 1,000 feet, detailed plans and specifications shall be submitted to and approved by the Department of Environmental Quality for collection and disposal of drill cuttings and mud, and other potential waste materials.

3. A contingency plan shall be submitted to the Department of Geology and Mineral Industries prior to any deep well drilling activities outlining the following information procedures.

   a. Measures taken to prevent emergency conditions or unplanned discharges, such as blowouts.

   b. A description of preventive facilities to contain or treat unplanned discharges.

   c. The reporting system to be used to alert facility management and appropriate legal authorities.

   d. A list of personnel and equipment available to respond to emergency conditions.

4. Upon determination of the Director of the Department of Environmental Quality or the Director of the Department of Geology and Mineral Industries that any activities conducted by the permittee in relation to its drilling operations or activities may tend to or will cause damage, hazards, pollution or risk to the environment of Oregon or may violate any conditions of permits issued by the aforementioned departments, the permittee shall when notified either orally or in writing by the Director of either department immediately cease and desist its drilling operations or activities until the problem has been corrected.

5. All drilling processes and all waste mud and waste waters collection, treatment and disposal facilities shall be operated and maintained at all times in a manner which will prevent a direct discharge or indirect discharge of any waste mud and waste waters to the waters of the state.

DEQ 4

6. All waste mud and waste waters are to be discharged into self-contained, non-overflow holding ponds.

7. All access roads, trails, drainage systems and the drilling site shall be constructed and maintained to minimize soil disturbances, control erosion and prevent channeling.

8. All refuse shall be disposed of at a refuse site which has a valid permit from the Department of Environmental Quality.

9. No geothermal waters, mineralized waters, oily waters or other waters or substances which might cause the Water Quality Standards of the State of Oregon to be violated shall be discharged or otherwise allowed to reach any of the waters of the state unless a permit for the discharge has been issued by the Department of Environmental Quality.

10. Sanitary wastes shall be disposed of in chemical or gas fired toilet facilities which have been installed in accordance with the recommendations of the Department and the local county health department or by other approved means.

11. In the event a breakdown of equipment or facilities causes a violation of any of the conditions of this permit or results in any unauthorized discharge, the permittee shall:

    a. Immediately take action to stop, contain and clean up the unauthorized discharges and correct the problem.

    b. Immediately notify the Department of Environmental Quality and the Department of Geology and Mineral Industries so that an investigation can be made to evaluate the impact and the corrective actions taken and determine additional action that must be taken.

    c. Submit a detailed written report describing the breakdown, the actual quantity and quality of resulting waste discharges, corrective action taken, steps taken to prevent a recurrence and any other pertinent information.

    Compliance with these requirements does not relieve the permittee from responsibility to maintain continuous compliance with the conditions of this permit or the resulting liability for failure to comply.

12. Authorized representatives of the Department of Environmental Quality or the Department of Geology and Mineral Industries shall be permitted access to the premises of all facilities owned and operated by the permittee at all reasonable times for the purpose of making inspections, surveys, collecting samples, obtaining data and carrying out other necessary functions related to this permit.

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

# ROAD SPECIFICATIONS

## INDEX

100 - GENERAL

200 - CLEARING AND GRUBBING

300 - EXCAVATION AND EMBANKMENT

400 - CORRUGATED METAL PIPE

500 - RENOVATION OF EXISTING ROADS

600 - WATERING

700 - AGGREGATE BASE COURSE (PIT-RUN)

1000 - AGGREGATE BASE COURSE (CRUSHED ROCK)

1300 - AGGREGATE SURFACE COURSE (CRUSHED ROCK)

1400 - SLOPE PROTECTION

ROAD SPECIFICATIONS

GENERAL - 100

101 - Definitions:

AASHTO - American Association of State Highway and Transportation Officials.

ASTM - American Society for Testing and Materials.

Plans - The approved drawings, or exact reproductions thereof, furnished by the Government, which show the locations, character, dimensions, and details of the work to be done.

Reasonably Close Conformity - Compliance with reasonable and customary manufacturing and construction tolerance where working tolerances are not specified; reasonably close conformity means compliance with such working tolerances.

Roadbed - The graded portion of the road within top and side slopes, prepared as a foundation for the pavement structure and shoulders.

Roadway - The portion of a road within limits of construction. Usually from the toe of the fill slope to the top of the cut slope.

Shoulder - The portion of the roadbed contiguous with the traveled way for accomodation of stopped vehicles, for safety purposes, and for lateral support of base and surface courses.

Specifications - A general term applied to all directions, provisions, and requirements pertaining to performance of the work.

Structures - Bridges, culverts, catch basins, retaining walls, underdrains, half-round culvert spillways, splash pads, downspouts, and other project features which may be involved in the work and not otherwise classed in these specifications.

Subgrade - The top surface of a roadbed upon which the traveled way and shoulders are constructed.

Traveled Way - The portion of the roadbed for the movement of vehicles, exclusive of shoulders.

Typical Cross Sections - Cross sectional plan of a typical roadway; usually three plans; cut and fill, through cut, and fill section.

Turnout - Extra widening of the roadbed at appropriate intervals on one-lane roads for passing purposes.

Subbase - Reinforcement of the subgrade with large particles of pit-run or crushed stone. Usually confined to roads having wet subgrades or subgrades with weak support characteristics.

Base Course - Lower layer(s) of a surfacing structure consisting of crushed gravel or stone, crushed sandstone, pit-run rock, bank or river-run gravels, etc., to provide support and, in the event no surface course is placed, the running surface for traffic load.

Surface Course - Top layer(s) of a surfacing structure consisting of finely crushed gravels or stone to provide a smooth running surface for traffic load.

Road Centerline - Longitudinal center of roadbed.

Spalls - Flakes or chips of stone.

Culvert - A pipe, pipe-arch, arch, or box structure constructed of metal, concrete or wood which provides an opening under the roadway primarily for the conveyance of water, pedestrians or livestock; exclusive of bridges.

Timber - Standing trees, downed trees, or logs which are capable of being measured in board feet.

## CLEARING AND GRUBBING - 200

201 - This work shall consist of clearing, grubbing, removing and disposing of vegetation, debris, surface objects and protruding obstructions within the clearing limits in accordance with these specifications (as shown on the plans) (and as staked on the ground)

203 - Clearing shall consist of the removal and disposal of trees, logs, rotten material, brush, and all other vegetative materials and surface objects in accordance with these specifications and within the limits established for clearing (as shown on the plans) (and as staked on the ground)

203a- Brush under (2)(6) feet in height need not be cut within the limits established for clearing.

203b- All standing trees and snags to be cleared shall be felled within the limits established for clearing (unless otherwise authorized)

204 - Grubbing shall consist of the removing and disposing of stumps, roots and other wood material embedded in the ground, and protruding obstacles remaining as a result of the clearing operation (in accordance with Subsection(s) - (204a)(204c)(204e) (between the top of the cut slope and the toe of the fill slope)

204a- All stumps shall be completely removed within the limits of required excavation. (Under no circumstances will stumps overhanging the top of the cut banks be allowed.)

204c- On excavation areas, all roots and embedded wood shall be removed to a depth not less than 6 inches below the subgrade to which excavation is constructed.

204e- All roots and embedded wood material shall be removed to a depth not less than one foot below embankment subgrades or slope surfaces.

205 - Clearing and grubbing debris shall not be placed or permitted to remain in or under any road embankment sections. (Such debris will however, be permitted to remain under waste material from full-bench construction.)

206 - Clearing and grubbing debris shall be disposed of by (scattering) (in accordance with Subsection 210)(and as shown on the plans)

CLEARING AND GRUBBING (Continued

210 - Stumps and cull logs shall be disposed of by scattering over government owned lands outside of established clearing limits in a manner acceptable to the Authorized Officer. The areas for such scattering shall have the prior approval of the Authorized Officer.

211 - No grading will be permitted prior to completion and written approval of the required clearing and grubbing work, except that stump grubbing may proceed with the excavation of the road prism.

212 - No clearing or grubbing debris shall be left lodged against standing trees.

## EXCAVATION AND EMBANKMENT - 300

301 - This work shall consist of excavating, overhaul, placement of embankments, backfilling, borrowing, leveling, ditching, grading, insloping, outsloping, crowning and scarification of the subgrade, compaction, disposal of excess and unsuitable materials, and all other earth moving work required in the construction of the road project.

302 - Excavation shall consist of the excavation of road cut sections and borrow sites, backfilling, leveling, ditching, grading, compaction and all other earth moving work necessary for the construction of a roadway in accordance with these specifications and in reasonably close conformity to the lines, grades, dimensions, typical cross section and locations shown on the plans (and as staked on the ground)

303 - All suitable material removed from the excavation shall be used in the formation of embankment subgrade, shoulders, slopes, bedding, and backfill for structures, and for other purposes as shown on the plans.

304 - Borrow shall consist of suitable material required for the construction of embankments or for other portions of the work; such material shall be obtained from sources shown on the plans, as indicated in these specifications, or from sources selected by the Purchaser at his option and approved by the Authorized Officer.

305 - Embankment construction shall consist of the placement of excavated and borrowed materials, backfilling, leveling, grading, compaction, and all other earth moving work necessary for the construction of the roadway in accordance with these specifications and in reasonably close conformity to the lines, grades, dimensions, typical cross section and locations shown on the plans (and as staked on the ground).

305a- All materials used in the construction of embankment sections shall be free of stumps, cull logs, brush, muck, sod, roots, frozen material, and other deleterious materials, and shall be placed as provided under Subsection(s) (305b)(305c)(318)(318a). Compaction of embankment layers shall be in accordance with Subsection(s) (306)(306a).

EXCAVATION AND EMBANKMENT - 300 (Continued)

305b- Embankment materials shall be placed in successive parallel layers, except in sidehill sliver fills, on areas cleared of all stumps, cull logs, brush, sod, and other vegetative and deleterous materials, except as provided under Subsection 204. Roadway embankments of earth material shall be placed in horizontal layers not exceeding (12)(24) inches in depth. Embankments formed of material containing less than 25 percent rock not larger than 8 inches in the greatest dimensions shall be placed in 12-inch layers. Material containing more than 25 percent rock not larger than 12 inches in the greatest dimension shall be placed in successive layers not exceeding 2 feet in thickness. Individual rocks and boulders greater than 12 inches in diameter may be used to construct 2 foot embankment layers, provided they are carefully distributed, with the interstices filled with fine material to form a dense and compact mass.

305c- Where embankments are constructed predominantly of blasted rock material, depth of layers shall not exceed 4 feet. Rock fragments having dimensions greater than 4 feet will be permitted provided that they have no dimensions greater than 6 feet and that clearance between adjacent fragments is adequate for the placing and compacting of material in horizontal layers as specified, and that no part of the larger fragments comes within 4 feet of subgrade.

306 - Compaction of embankment layers placed as specified under Subsection 305a above, shall be accomplished by routing construction equipment over full width of embankment structures.

306a- Layers of (embankment)(selected borrow)(selected roadway excavation) material placed as specified under Subsection(s) (305a)(305b)(318) shall be moistened or dried to a uniform moisture content suitable for maximum compaction and compacted to full width with compacting equipment conforming to the requirements of Subsection(s) (307a)(307b) (307e). (Minimum compaction shall be one hour of continuous compacting for each 150 cubic yards or fraction thereof, of) (embankment) (selected borrow)(selected roadway excavation)(material placed per layer.) (Minimum compaction shall be one hour of continuous compacting for each 4 stations of road, or fraction thereof, as measured along the centerline of the constructed road for each layer of (embankment) (selected borrow) (selected roadway excavation) (material placed.)

307- Compaction Equipment shall meet the following requirements:

(a) Tamping rollers. A tamping roller unit shall consist of two watertight metal drums mounted in frames in such a manner as to be fully oscillating, together with a tractor having sufficient weight and power under actual working conditions to pull the roller drums at a minimum speed of 2.5 miles per hour. The drums shall be not less than 60 inches in diameter and not less than 54 inches in length, measured at the drum's durface, and shall be studded with tamping feet projecting not less than 7 inches from the face of the drums. The distance between circumferential rows or tamper feet shall be such that the diagonal distance from any foot to the nearest foot in each adjacent row shall be not more than 12 inches, measured center-to-center of feet at the surface of the drums. The cross-sectional area of the face of each tamper foot, measured perpendicular to the axis of the stud, shall be not less than 5½ square inches nor more than 8 square inches.

The weight of the tamping roller unit shall be such as to exert a minimum pressure of 250 pounds per square inch on the ground area in contact with the tamping feet, and the roller shall be so designed that the weight may be increased to exert a pressure up to 500 pounds per square inch on the ground area in contact with the tamping feet. The ground pressure shall be determined by dividing the total weight of the tractor, by the total cross-sectional area of the tamping feet in one row of tamping feet parallel to the axis of the roller.

(b) Smooth-wheel power rollers. Smooth-wheel power rollers shall either be of the 3-wheel type, weighing not less than 10 tons, or of the tandem type, 2-wheel or 3-wheel, weighing not less than 8 tons. Smooth-wheel roller shall provide compression of 325 pounds per lineal inch of width of rear wheels or drum.

(d) Grid-roller. A grid roller shall consist of two or more cylindrical drums independently mounted on a common shaft in a rigid frame. Each drum shall have a minimum outside diameter of five feet and a minimum width of two feet six inches. The over-all width of the roller exclusive of frame shall be not less than five feet six inches of which not more than six inches shall be used for center spacing between two roller drums. The face of the drums shall have the appearance of woven open-mesh made by interlacing bars of not less than one and one-quarter inches nor more than one and three-quarter inches diameter spaced on four and one-half inch to five and one-half inch centers. Net opening between the bars shall be not less than three inches nor more than four inches. The roller shall be so constructed that counter weights can be used to adjust the gross weight of the roller to not less than 30,000 pounds. The grid roller shall be drawn by a power unit capable of propelling the fully loaded roller through six inches of loose embankment material at a speed of at least four miles per hour.

(e) Vibratory Roller. The drum diameter shall not be less than 48", the drum width not less than 58", and the turning radius 15 feet or less. Vibration frequency shall be regulated in steps to 1400, 1500, and 1600 VPM, corresponding to engine speeds of 1575, 1690, and 1800 VPM. The centrifugal force developed shall be 7 tons at 1600 VPM. It shall be activated by a power unit of not less than 25 hp. The vibratory roller shall be self-propelled or drawn by a vehicle of sufficient horsepower to enable the unit to travel through a loose layer of material at a speed ranging from 0.9 mile to 1.8 miles per hour, as directed by the Authorized Officer.

The towing vehicle and roller or self-propelled unit meeting the above requirements shall be considered a vibratory roller unit.

309 - In the case of rock fills, placement of material in layers is not required and such material may be placed by the end dumping method or other methods satisfactory to the Authorized Officer provided, however, that the rock must be reasonably prevented from escaping beyond the embankment toe.

311 - In solid rock cuts where pockets that will not drain are formed by blasting below the subgrade elevation, drainage shall be provided by ditching to the edge of the subgrade and backfilling both the pockets and the ditch with fragmentary rock, gravel, or other suitable porous material to grade and compacing.

312 - When material, except solid rock, is encountered in cuts at subgrade and is suitable for use in forming the finished roadbed, the top six inch layer of the subgrade for the full width of the roadbed shall be thoroughly scarified and roots, sod or other deleterious material or stones that will not pass a six-inch square opening, shall be removed. The scarified material shall be processed to an acceptable moisture content and compacted in accordance with these specifications (in accordance with Subsection 306a).

313 - In cut areas where solid rock is encountered at, or near subgrade, the rock shall be excavated to a minimum depth of 6 inches below subgrade elevation and the excavated area backfilled with suitable material. The backfill material shall be processed to a uniform moisture content suitable for maximum compaction and compacted to full width in accordance with the requirements of Subsection(s) (306)(306a).

EXCAVATION AND EMBANKMENT - 300 (Continued)

314 - When heavy clays, muck, clay shale or other unsuitable material for forming the roadbed is encountered in cuts at subgrade, it shall be excavated to a minimum depth of 2 feet below subgrade elevation and the excavated area backfilled with a selected borrow material approved by the Authorized Officer. The backfill material shall be processed to a uniform moisture content suitable for maximum compaction and compacted in accordance with the requirements of Subsection(s) (306) (306a). Unsuitable material shall be disposed of as directed by the Authorized Officer.

NOTE - Additional excavation or disposal, when required under subsections 313 - 314 should not be viewed as a design change under Section 20 of Form 5450-3.

315 - Borrow material required for the construction of embankment or for other portions of the work shall be obtained from sources as shown on the plans (along and parallel to the roadway from Sta_____ to sta _____approximately, and from sta_____to sta_____ approximately, etc.).

316 - All borrow material from sources selected at the Purchaser's option shall be inspected and approved by the Authorized Officer prior to excavation of borrow material.

317 - Selected borrow shall consist of talus material, finely broken rock, gravel or other material of granular or favorable characteristics from sources shown on the plans.

317a- Where indicated on the plans, the Purchaser shall conserve excavation material consisting of talus material, gravel, finely broken rock or other material of granular or favorable characteristics for placement on the top portions of the roadbed as shown on the plans and as directed by the Authorized Officer.

318 - Selected borrow or selected roadway excavation material shall be uniformly spread on the roadbed in lifts not to exceed_____* inches in depth until the required thickness shown on the plans is attained. Each layer shall be moistened or dried to a uniform moisture content suitable for maximum compaction and compacted to full width in accordance with the requirements of Subsection 306a.

*NOTE - Thickness of lift selected for Subsection 318 is dependent on type and natural gradation of selected borrow or selected roadway excavation materials utilized in the construction of the roadbed. Usually "oversize" material is considered to be particles larger than 2/3 the thickness of the individual lift.

EXCAVATION AND EMBANKMENT - 300(Continued)

318a- Selected borrow or selected roadway excavation material shall be uniformly spread on the roadbed to a depth which after settlement will provide the depth shown on the plans. Compaction shall be accomplished by routing construction and hauling equipment over the full width of the road bed.

319 - Borrow pits shall be subject to the development, operation, and reclamation requirements set forth under Section 1600 of these specifications.

320 - Ditches shall conform to the slope, grade, dimensions and shape of the required cross section shown on the plans. All roots, stumps, rocks and other projections shall be removed to form smooth, even slopes.

321 - Excess excavated, unsuitable, or slide materials shall be disposed of in accordance with Subsection(s) (321a) (321b) (321c).

321a- Excess construction materials specified under Subsection 321 shall be loaded, overhauled and placed as additional embankment to widen the roadbed from sta._____to sta_____, approximately, and from sta_____to sta_____, approximately, etc. as shown on sheet____ of the plans.

321b- Excess construction material as specified under Subsection 321 shall be loaded, overhauled and disposed of at a disposal site located in the _____ as shown on sheet____ of the plans.

321c- The end dumping method will be permitted for the placement of excess materials under Subsection 321 in designated disposal areas or within area approved by the Authorized Officer. Watering and rolling are not required. However, the materials placed shall be sloped and shaped and otherwise brought to a neat and sightly condition acceptable to the Authorized Officer.

322 - When so indicated on the plans, selected coarse rock encountered in the excavation shall be conserved for slope protection or special rock embankment purposes and placed in accordance with the requirements and details of Section 1400 of these specifications and as shown on the plans.

324 - Excavated material shall not be allowed to cover boles of standing trees to a depth in excess of 2 feet on the uphill side.

327 - The finished grading shall be approved in writing by the Authorized Officer (prior to surfacing) (in segments or for the total project).

## CORRUGATED METAL PIPE - 400

401 - This work shall consist of the furnishing and installation of pipe culverts, pipe arch culverts and half-round spillways in accordance with these specifications, and conforming to the types, sizes, gages, and the total cumulative length shown on the plans. Individual pipe culvert and pipe-arch culvert lengths, half-round spillways and locations shown on the plans are approximate; final lengths and locations will be determined by the Authorized Officer (from established construction stakes) (upon completion of the roadbed). Additional pipe may be required at the option of the Authorized Officer in which case a reduction in the total purchase price shall be made to offset the cost of furnishing and installing such additional pipe based upon the unit prices set forth in the current BLM Timber Appraisal Production Cost Schedule.

402 - When shown on the plans, pipe culverts and pipe arch culverts shall be installed in such a manner as to not impede fish passage.

402a- The pipe culvert(s) (pipe-arch culvert(s)) located at sta(s)_____ _____as shown on the plans, shall be installed in such a manner as to not impede fish passage. Gradient of pipe shall not exceed 0.5 percent, and minimum water depth at any point in the structure shall be 8 inches. (Baffles shall be installed in accordance with the standard design sheet(s) for baffle fabrication included in the plans where water velocities in excess of thos permissible for fish passage are indicated. Where called for on the plans) (and as staked on the ground) (pipe invert grade line shall be depressed_____ inches below normal stream bed level at the inlet).

407 - Any damage to the spelter, or burn back in excess of 3/8 inch, shall be wire brushed and painted with 2 coats of zinc-rich paint complying with Federal Spec. TT-P-641b.

408 - Corrugated steel riveted, welded and helical pipe culverts and pipe-arch culverts shall conform to the requirements of AASHTO M36-74 and ASSHTO M218-74.

408c- Corrugated steel structural plate pipe culverts and pipe-arch culverts shall conform to the requirements of AASHTO M167-72, except that single plates may exceed 75.0 pounds in weight.

409 - Coupling bands shall conform to the requirements of AASHTO M36-24 and AASHTO M218, with the exception of band widths and the "Hugger" type band, which shall conform to the details, dimensions and typical diagram shown on the plans.

CORRUGATED METAL PIPE - 400 (Continued)

409a- "Hugger" type coupling bands shall only be used with annular corrugated pipe culverts and pipe-arch culverts. Helically corrugated end sections may be joined by the "Hugger" type coupling. Such end sections shall consist of 2 annular corrugations and fabricated as shown on the plans.

409b- Coupling bands produced from flat galvanized steel sheets with impressed dimples will be permitted only for connecting annular corrugated steel pipe to helically corrugated steel pipe, and for connecting metal end sections to pipe culverts. Such coupling bands shall conform to the width requirements shown on the plans.

409c- Coupling bands produced from flat galvanized steel sheets with impressed dimples will be permitted for connecting all types of corrugated steel pipe culverts where the gradient of the structure is less than 15 percent. Where the gradient is 15 percent or greater, "Hugger" or annular coupling bands are required. All such coupling bands shall conform to the width requirements shown on the plans.

411 - Pipe culverts and pipe-arch culverts shall be placed on the bed starting at the downstream end with the inside circumferential laps pointing downstream and with the longitudinal laps at the side or quarter points. Coupling bands of the types required under these specifications shall be so installed as to provide the circumferential and longitudinal strength necessary to preserve the pipe alignment, prevent separation of the pipe sections and minimize infiltration of fill material.

412 - Structural plate pipe culverts and pipe-arch culverts shall be installed in accordance with the plans and detailed erection instructions furnished by the manufacturer. (One copy of the erection instructions shall be furnished the Authorized Officer prior to erection).

413 - Where required by the plans, the vertical diameter of pipe culvert shall be increased 5 percent by shop elongation.

414 - All pipe shall be unloaded and handled with reasonable care. If the Authorized Officer determines any structure to be damaged to the extent that it is unsuitable for use in the road construction, it shall be replaced at the Purchaser's expense.

415 - Trenches necessary for the installation of pipe culverts or pipe-arch culverts shall conform to the lines, grades, dimensions and typical diagram shown on Exhibits (C1) (C2)_____, included in the plans.

CORRUGATED METAL PIPE - 400 (Continued)

416 - Where ledge rock, boulders, soft or spongy soils are encountered, they shall be excavated a minimum of 8 inches below the invert grade for a width of at least one pipe diameter or span on each side of the pipe and shall be backfilled with gravel or other selected granular or fine readily compactible soil material.

418 - The invert grade of the bedding shall be cambered in accordance with the requirements and details shown on the plans and as directed by the Authorized Officer.

418a- The invert grade of the bedding shall be cambered at the middle ordinate a maximum of one percent of the total length of the drainage structure. Camber shall be developed on a parabolic curve.

419 - Pipe found to be out of alignment, unduly settled or damaged shall be taken up and relaid or replaced as directed by the Authorized Officer.

420a- For (pipe culvert) (pipe-arch culverts) (located at sta(s)_____ _____(side fill material within) (____pipe diameter) (pipe span) or a minimum of_____feet, of the sides of the pipe barrel, and to_____foot over the pipe shall be fine, readily compactible soils or granular fill material free from excess moisture, muck, frozen material, roots, sod, or other deleterious material devoid of rocks or stones of sizes which may impinge upon and damage the pipe or otherwise interfere with proper compaction. Material that will cause serious corrosion of the pipe shall not be used for side fills. (Granular fill material shall be well graded with (100) percent passing the (3/8 - inch sieve and not more than (10) percent passing the No. (200)sieve.)

421 - For (pipe culverts) (pipe-arch culverts) (located at sta(s)_____ _____ the side fill material conforming to the requirements of Subsection 420a shall be placed and compacted under the haunches of the pipe, and shall be brought up evenly and simultaneously on both sides of the pipe, and to one foot above the pipe, in layers not exceeding 6 inches in depth and one pipe diameter/span, or a minimum of 2 feet in width on each side of, and adjacent to the full length of the pipe barrel. Each layer shall be moistened or dried to a uniform moisture content suitable for maximum compaction and immediately compacted by approved hand or pneumatic tampers until a uniform density (of not less than 85 percent of the maximum density as determined by a properly calibrated nuclear testing device is attained) (of not less than 95 percent of a maximum density as determined by AASHTO T99-74, Method C, is attained).

CORRUGATED METAL PIPE - 400 (Continued)

423 - The pipe culvert(s) (pipe-arch culvert(s)) located at sta(s)_____ _____ after being bedded and backfilled as required by these specifications shall be protected by a ____ -foot cover of fill before heavy equipment is permitted to cross the drainage structure(s) during construction of the roadway. Removal of the protection fill shall be as directed by the Authorized Officer.

424 - Catch basin (and ditch dams) shall be constructed for (all grade culverts) (and) (culverts located at sta(s)_____ _____(of road No._____ conforming to the lines, grades, dimensions and typical diagram shown on Exhibit _____, included in the plans.

425 - Splash pads (energy disipators) shall be constructed for culverts (located at sta(s)_____, of road No._____(at locations shown on the plans) in accordance with the construction requirements and details shown on Exhibit _____, included in the plans and as directed by the Authorized Officer.

426 - Where pervious materials are used for backfill and bedding, collars consisting of selected impervious material shall be placed at the inlet and at various intervals along the pipe barrel as shown on the plans and as directed by the Authorized Officer.

427 - Culvert markers consisting of steel fence posts shall be furnished, fabricated, and installed by the Purchaser at all grade culverts (at culverts located at sta(s) _____ _____ _____) as shown on the plans and as directed by the Authorized Officer.

NOTE - Catch basins, splash pads, impervious collars, and culvert markers are considered appraisal entities and the costs of these items are in addition to the price of the corresponding culvert structure.

## RENOVATION OF EXISTING ROADS - 500

501 - This work shall consist of reconditioning and preparing the roadbed and shoulders, cleaning and shaping drainage ditches, clearing vegetation from cut and embankment slopes, and clearing and repairing drainage structures of existing roads in accordance with these specifications, as shown on the plans (and as staked on the ground.)

502 - The road bed and drainage ditches of existing Road No. _____, (from sta_____to sta_____,(shall be reconditions in accordance with the requirements and details of Subsection(s) 502a - 502b - 502c.)

502a- The roadbed subgrade shall be scarified for its full width and to a depth sufficient to eliminate surface irregularities. The scarified surface shall then be bladed and shaped to the lines, grades, dimensions and typical cross section shown on the plans (and as staked on the ground.)

502b- Drainage ditches shall be bladed and shaped in accordance with the lines, grades, dimensions and typical cross section shown on the plans.

502c- All rocks larger than 4 inches in maximum dimension shall be removed from the scarified layers of the roadbed. Material so removed will not be permitted to remain on road shoulders or in ditches.

503 - Debris from slide(s) located at sta(s)_____of Road No._____shall be disposed of by direct side cast.

503a- Debris from slide(s) located at sta(s)_____shall be overhauled to designated disposal sites (as shown on the plans) as staked on the ground.

504 - Compaction of scarified material as bladed and shaped in accordance these specifications shall be achieved by routing construction equipment over full width of roadbed.

504a- The scarified roadbed as bladed and shaped in accordance with these specifications shall be moistened or dried to a uniform moisture content suitable for maximum compaction and compacted to full width. Minimum compaction required shall be one (1) hour of continuous (rolling) (tamping) with compaction equipment conforming to the requirements of Subsection(s) (307a)(307b)(307e) for each four (4) stations of road, or fraction thereof, as measured along the centerline, per layer of scarified roadbed material.

506 - The inlet of (all) existing drainage structures (located at sta(s) _____) shall be cleared of vegetative debris and boulders of sufficient size to obstruct normal stream flow. Pipe inverts shall be cleared of sediment and other debris lodged in the barrel of the pipe. The outflow area of (all) (designated) pipe structures shall be cleared of rock and vegetative obstructions which will impede the structure's outflow. Catch basin shall conform to the lines, grade, dimensions, and typical diagram shown on the plans.

507 - Existing drainage structures located at sta(s)_____ shall be replaced with structures of the type, gage, diameter and length shown on the plans and in accordance with the placement requirements set forth under Section 400 of these specifications.

508 - All vegetation encroaching on the roadbed and drainage ditches of existing Road No._____shall be removed by cutting and disposed of by scattering in accordance with Section 200 of these specifications.

508a- All vegetation less than _____inches in diameter located (in the areas shown on the plans) (within_____feet of both shoulders) (and where it prevents a sight distance of _____ feet) shall be cut within _____inches of the ground. Resulting debris shall be disposed of in accordance with Section 200 of these specifications.

## WATERING - 600

601 - Watering shall consist of furnishing and applying water required for the compaction of embankments, roadbeds, backfills, base courses, surface courses, finishing and reconditioning of existing roadbeds and for laying dust or for other uses in accordance with these specifications, as shown on the plans and as directed by the Authorized Officer.

602 - Water, when needed for compaction or laying dust, shall be applied at the locations, in the amounts and during the hours as directed by the Authorized Officer, Amounts of water to be provided will be the minimum needed to properly execute the compaction requirements of these specifications, and for laying dust during work periods where the road crosses private property.

603 - Water trucks used in this work shall be equipped with a distributing device of ample capacity and of such design as to ensure uniform application of water on the roadbed.

## AGGREGATE BASE COURSE - 700

### PIT RUN ROCK MATERIAL

701 - This work shall consist of furnishing, hauling and placing one or more layers of pit-run rock material on approved roadbed in accordance with these specifications and conforming to the lines, grades, dimensions and typical cross section shown on the plans.

702 - Pit-run rock materials used in this work shall be obtained from source shown on the plans. Development and mining of such source(s) shall be in accordance with (Subsection 1601) (Subsection 1602) of these specifications.

NOTE - Use subsection 702 if pit-run rock is available from sources located on public lands or private lands under permit within the project area.

702a- Pit-run rock materials used in this work may be obtained from source(s) selected by the Purchaser, at his option, providing the materials furnished comply with these specifications (and the source(s) is approved in writing by the Authorized Officer prior to use.)

703 - Pit-run rock materials shall consist of talus rock, bank run or river run gravels, partly decomposed granite of basalt, cinders, or other approved materials. The materials shall be reasonably free from vegetative matter or other deleterious material.

704 - Pit-run rock material shall consist of native materials of such a size and grading that they can be taken directly from the source and placed on the road without crushing or screening. The material shall contain only occasional oversize particles to be removed. The term "oversize" shall be construed to mean material greater than 2/3 the compacted thickness of the layer in which it is placed.

705 - Pit-run rock material shall be placed in layers of sufficient thickness to accommodate the material, except that the maximum thickness of any layer shall not exceed _____ inches. Where the total specified thickness is greater than _____ inches, the material shall be placed in two or more layers of equal thickness. **

706 - Oversize material that cannot be accommodated in the layers shall be removed at the source or on the road, and shall be disposed of as shown on the plans or as directed by the Authorized Officer.

** NOTE - Thickness of layer is dependent on type and natural gradation of pit-run rock material available.

707 - When so indicated by the plans, filler or binder obtained from source shown on the plans shall be uniformly blended with pit-run rock material on the road.

708 - The roadbed as shaped and compacted under section (300)(500) of these specifications shall be approved by the Authorized Officer prior to placement of pit-run rock material.

709 - Pit-run rock material shall be placed on roadbed and blade - processed and spread to required dimensions.

710 - Pit-run rock material shall be compacted by operating construction and hauling equipment over the full width of each layer placed.

711 - Layers of pit-run rock material placed and shaped as specified shall be moistened or dried to optimum moisture content for maximum compaction and compacted to full width by compacting equipment conforming to the requirements of Subsection (307b)(307d)(307e). Minimum compaction shall be one 1 hour of continuous compacting for each 250 cubic yards, or fraction thereof, of pit-run rock material placed per layer.

712 - The pit-run rock material shall be surface pladed during the compaction operation to remove irregularities and to produce a smooth running surface.

NOTE - If the stockpiling of pit-run rock materials is a contract requirement, use applicable Subsections under Section 1000 of these specifications to cover construction and rehabilitation of temporary stockpile sites and access roads thereto.

## AGGREGATE BASE COURSE - 1000
## CRUSHED ROCK MATERIAL

1001 - This work shall consist of (furnishing) hauling and placing one or more lifts of crushed rock material on approved roadbed in accordance with these specifications and conforming to the lines, grades, dimensions and typical cross sections shown on the plans. Any material not conforming to these specifications will be rejected.

1002 - Crushed rock materials used in this work shall consist of quarry rock, stone, gravel or other approved materials obtained from source(s) shown on the plans. Development and mining of such source(s) shall be in accordance with (Subsection 1601)(Subsection 1602) of these specifications.

Note: Where crushed rock surfacing materials have been appraised from a commercial source use Subsection 1002a. Source comprising appraisal basis should be thoroughly investigated to ascertain quantity and quality of rock materials available to BLM Purchasers.

1002a- Crushed rock materials used in this work may be obtained from commercial source(s) selected by the Purchaser, at his option providing the rock materials furnished comply with these specifications.

1003 - When crushed rock material is produced from gravel, not less than 50 percent by weight of the particles retained on the No. 4 sieve will have 1 fractured face.

1004 - Crushed base course materials shall consist of hard durable rock fragments conforming to the following gradation requirements:

TABLE 1004

AGGREGATE BASE COURSE
CRUSHED ROCK MATERIAL

Percentage by Weight Passing square Mesh Sieves

| Sieve Designation | GRADING A | B | C | D |
|---|---|---|---|---|
| 3-inch | 100 | | 100 | |
| 2-inch | | 100 | | 100 |
| 1-1/2 inch | | | | |
| 1-inch | 45-75 | 50-90 | - | - |
| 3/4-inch | | | | |
| 3/8-inch | | | | |
| No. 4 | 15-45 | 15-50 | - | - |
| No. 10 | | | | |
| No. 40 | 5-25 | 5-25 | - | - |
| No. 200 | 0-15 | 0-15 | - | - |

AGGREGATE BASE COURSE - 1000 (Continued)

1005 - Crushed rock material retained on the No. 4 sieve shall have a percentage of loss of not more than 35 at 500 revolutions as determined by AASHTO T96-74.

1006 - Crushed rock material shall show durability value of not less than 35 as determined by AASHTO T210-72.

1007 - That portion of crushed rock material passing the No. 40 sieve, including blending filler shall have a liquid limit of not more than 35 , and a platicity index of not less than 4 and not more than 12 as determined by AASHTO T89 and AASHTO T90-70.

1009 - The roadbed as shaped and compacted under Section (300)(500) of these specifications shall be approved by the Authorized Officer prior to placement of crushed rock material.

1010 - Crushed rock material conforming to the requirement of these specifications shall be placed on the approved roadbed in accordance with the lines, grades, dimensions, and typical cross sections shown on the plans, in accordance with these specifications (and as staked on the ground) and compacted in layers not to exceed ___ inches in depth. When more than one layer is required, each shall be shaped and compacted before the succeeding layer is placed. Any irregularities or depressions that develop during compaction of the top layer shall be corrected by loosening the material at these places and adding or removing material until the surface is smooth and uniform.

1012 - Each layer of crushed rock material for base placed and shaped as specified shall be thoroughly mixed to the full depth of the layer by alternately blading the entire layer across the center of the road and back to the edges of the road. The materials shall be moistened or dried to a uniform moisture content suitable for maximum compaction. When uniformly mixed and wetted, the mixture shall again be spread smoothly to the required cross section and depth and compacted to full width by compaction equipment conforming to the requirements of Subsection (307b)(307e) . Minimum compaction shall be one (1) hour of continuous compacting for each 150 cubic yards, or fraction thereof, of crushed rock material placed per layer.

AGGREGATE BASE COURSE - 1000 (Continued)

1015 - The Purchaser is authorized to remove _____ cubic yards, stockpile measure, of Grad._____crushed base course material from existing BLM stockpile site No._____, located in the _____Sec_____, T.____, R._____, Will. Mer., for placement on road No.(s)_____ in accordance with the requirements and details shown on the plans. Additional crushed base course material, if required to complete the designed surfacing on the above specified road(s), may be obtained from the designated stockpile site(s), providing the removal of such material has the prior written approval of the Authorized Officer. (Records of quantities removed from the designated site(s) stockpile shall be submitted to the Authorized Officer upon completion of the surfacing operation.)

1015b -Approximately_____cubic yards, stockpile measure, of Grad._____ crushed base course material are available at BLM stockpile No._____, located in the_____Sec._____ T._____R._____, Will. Mer. The Purchaser is authorized to use material from this source to surface the designated road. _____cubic yards of additional crushed base course material will be needed to complete the surfacing and shall be furnished by the Purchaser as provided under Subsection 1001.

1016 - The Purchaser shall place in stockpile _____ cubic yards (truck measure) (stockpile measure) (of Grad._____crushed base course material at site(s) shown on the plans. Such material shall be used as shown on the plans and as directed by the Authorized Officer. All crushed rock material so stockpiled shall be placed on the designated road(s) prior to termination of the Timber Sale Contract.

## AGGREGATE SURFACE COURSE - 1300
## CRUSHED ROCK MATERIAL

1301 - This work shall consist of (furnishing) hauling, and placing one or more layers of crushed rock materials on approved (roadbed)(base course) in accordance with these specifications and conforming to the lines, grades, dimensions, and typical cross-sections shown on the plans. Any material not conforming to these specifications will be rejected.

1302 - Crushed rock materials used in this work shall consist of quarry rock, stone, gravel, or other approved materials obtained from source(s) shown on the plans. Development and mining of such source(s) shall be in accordance with (Subsection 1601)(Subsection 1602) of these specifications.

Note: Where crushed rock materials have been appraised from a commercial source, use Subsection 1302a. Source comprising appraisal basis should be thoroughly investigated to ascertain quantity and quality of rock materials available to BLM Purchasers.

1302a- Crushed rock materials used in this work may be obtained from commercial source(s) selected by the Purchaser, at his option, providing the rock materials furnished comply with these specification.

1303 - When crushed rock material is produced from gravel, not less than 50 percent by weight of the particles retained on the No. 4 sieve will have 1 fractured face.

1304 - Crushed surface course materials shall consist of hard durable rock fragments conforming to the following gradaiton requirements:

TABLE 1304

AGGREGATE SURFACE COURSE
CRUSHED ROCK MATERIAL

| Sieve Designation | Grading Designation and Maximum Size C (1½") | D (1") | E (3/4") |
|---|---|---|---|
| 1½ inch | 100* | - | - |
| 1 inch | - | 100 | - |
| 3/4 inch | 55-90 | - | 100 |
| 1/2 inch | - | - | - |
| No. 4 | 25-50 | 30-60 | 40-75 |
| No. 40 | 5-25 | 5-30 | 5-35 |
| No. 200 | 2-15 | 2-15 | 2-15 |

*Percentage by weight passing square mesh sieves.

Note: If the districts have previously determined a more applicable gradation requirements for certain rock types occurring within their operational area such gradation may be used contingent on prior approval by the State Office.

1305 - Crushed rock material retained on the No. 4 sieve shall have a percentage of loss of not more than 35 at 500 revolutions as determined by AASHTO T96-74.

1306 - Crushed rock material shall show a durability value of not less than 35 as determined by AASHTO T210-72.

1307 - That portion of crushed rock material passing the No. 40 sieve, including blending filler shall have a liquid limit of not more than 35 and a plasticity index of not less than 4 and not more than 12 as determined by AASHTO T89-68 and T90-70 respectively.

1309 - The (roadbed) (base course) shall be shaped and compacted in accordance with the requirements set forth in Section (300)(500) of these specifications prior to placing the crushed rock material.

AGGREGATE SURFACE COURSE - 1300 (Continued)

1310 - Crushed rock material conforming toe the requirements of these specifications shall be placed on the approved (roadbed)(base course) in accordance with the lines, grades, dimensions and typical cross section shown on the plans, these specifications (as staked on the ground)
and compacted in layers not to exceed____ inches in depth. When more than one layer is required, each shall be shaped and compacted before the succeeding layer is placed. Any irregularities or depressions that develop during compaction of the top layer shall be corrected by loosening the material at these places and adding or removing material until the surface is smooth and uniform.

1312 - Each layer of crushed rock material for based placed and shaped as specified shall be thoroughly mixed to the full depth of the layer by alternately blading the entire layer across the center of the road and back to the edges of the road. The materials shall be moistened or dried to a uniform moisture content suitable for maximum compaction. When uniformly mixed and wetted, the mixture shall again be spread smoothly to the required cross section and depth and compacted to full width by compaction equipment conforming to the requirements of Subsection (307b)(307e) Minimum compaction shall be one (1) hour of continuous compacting for each 150 cubic yards, or fraction thereof, of crushed rock material placed per layer.

1317 - The Purchaser is authorized to remove_____cubic yards, stockpile measure, of Grad_____crushed rock material from BLM stockpile site No._____, located in the_____, Sec._____, T._____, R._____Will. Mer., and stockpile site No._____, Sec._____, T_____, R_____, Will. Mer. etc., for placement on road No.(s)_____
in accordance with the requirements and details shown on the plans. Additional crushed surface course material, if required to complete the designed surfacing on the above specified road(s), may be obtained from the designated stockpile site(s), providing the removal of such material has the prior written approval of the Authorized Officer. (The purchaser shall maintain records of all material removed from each of the stockpile site designated above. These records shall be submitted to the Authorized Officer upon completion of the surfacing operation.)

1318 - Approximately____cubic yards, stockpile measure, of Grad.____crushed rock material are available at BLM stockpile site No._____, located in the_____Sec._____, T._____,R_____, Will. Mer. The Purchaser is authorized to use all material from this stockpile site to surface the designated road. _____cubic yards of additional crushed rock material is required to complete the surfacing and shall be furnished by the Purchaser and in accordance with these specifications and as shown on the plans.

AGGREGATE SURFACE COURSE - 1300 (Continued)

1320 - The Purchaser shall place in stockpile_____cubic yards (truck measure) (stockpile measure) Grad._____crushed rock material at site(s) shown on the plans. Such material shall be used to reinforce and repair areas of deficient support which appear during the hauling operation. All crushed rock material so stockpiled shall be placed on the designated road prior to termination of the timber sale.

## SLOPE PROTECTION - 1400

1401 - This work shall consist of stone materials for bank protection furnished and constructed in accordance with these specifications and conforming to the lines, grades, dimensions and typical diagram, and at the locations shown on the plans.

1402 - Slope protection material shall consist of (hard angular quarry rock) (blasted rock and coarse stone from roadway excavation) of such quality that it will not disintegrate on exposure to water or weathering, and shall be graded in accordance with Subsection(s) (1402a)(1402b) (1402c)(1402d).

1402a -Individual stones shall vary in weight from 20 to 400 pounds each. Not less than 25 percent of the individual stones shall weight from 200 to 400 pounds each.

1402b- The size of stones by volume shall be as follows:

| Size of stone | Percent of total volume Smaller than given size |
|---|---|
| 4 cu ft | 100 |
| 3 cu ft | 80 |
| 1 cu ft | 50 |
| 1/8 cu ft | 0-10 |

The material shall be well graded from the smallest to the maximum size specified. Stones smaller than the specified 10 percent size shall consist of spalls and fine rock fragments so distributed as to provide a stable compact mass.

1402c- The size of stones by volume shall ba as follows:

| Size of stone | Percent of total volume Smaller than given size |
|---|---|
| 2/3 cu ft | 100 |
| 1/3 cu ft | 80 |
| 1/6 cu ft | 50 |
| 1/100 cu ft | 0-10 |

The material shall be well graded from the smallest to the maximum size specified. Stones smaller than the specified 10 percent size shall consist of spalls and fine rock fragments so distributed as to provide a stable compact mass.

SLOPE PROTECTION - 1400 (Continued)

1402d- Not more than 10 percent of the total volume of slope protection material shall consist of stones having a volume of less than 0.5 cubic foot and at least 50 percent of the total volume shall consist of stones having a volume of 2 cubic feet or more. The 10 percent portion less than 0.5 cubic foot in size shall consist of spalls and fine rock fragments so distributed as to provide a stable compact mass.

1403 - Determination of the acceptability of the slope protection material gradation will be through visual inspection by the Authorized Officer.

1404 - Trenches for slope protection structures shall be excavated to the lines, grades, elevations and typical diagram shown on the plans. They shall be of sufficient size to permit the placing of structure footings of the full widths and length shown. All trenches shall be approved by the Authorized Officer prior to placement of slope protection material.

1404a- Foundation trenches and other required excavation as shown on the plans shall be approved prior to placing the slope protection material.

1405 - Slope protection material shall be placed so as to form the cross sections shown on the plans. The face of the slope protection structure above low water line shall be uniform, free from humps or depressions and with no excessively large cavities below or individual stones project above the general surface.

1406 - The placement of slope protection rock in layers will not be required. Such material may be placed by the end dumping method or other methods approved by the Authorized Officer provided the rock materials placed shall be reasonably prevented from escaping beyond the embankment toe.

1407 - The embankment slopes from sta._____to sta._____and from sta._____to sta._____, approximately, etc., of road No._____shall be protected and (or) stabilized by placement of rock materials to form a slope protection structure conforming to the construction requirements and details of (these specifications) (Subsections (1401)(1402)(1403)(1404).

APPENDIX L

## MISCELLANEOUS CONSTRUCTION, DEVELOPMENT, OPERATION AND RECLAMATION STIPULATIONS

1. Lessee shall maintain roads it is authorized to build in a condition suitable for use by passenger type vehicles and to reasonably protect such road from winter weather.

2. Whenever the Lessee uses roads owned or controlled by the United States for the transportation of petroleum products or by-products resulting from operations of lessee, it shall be responsible for road maintenance as follows:

(a) If the road is maintained by the United States or its licensees, the lessee shall pay the United States a maintenance fee during periods of use be lessee. Such maintenance fee shall be determined by the Authroized Officer of the Bureau of Land Management.

(b) If the road is not being maintained by the United States or its licensees, the lessee shall maintain said road during periods of use by it in as good a condition as prior to its use, and the lessee shall be entitled to collect maintenance expense from others who use the road for commercial hauling pruposes including the United States and its licensees.

3. Roads and drill pads constructed and/or used by the lessee shall be surfaced by lessee if intended for wet season or long term use.

4. An unsurfaced road constructed by the lessee shall be ripped, water barred and revegetated with native plant species by lessee, as directed by the District Engineer, Geological Survey, when such road is no longer needed by lessee.

5. Cut and fill slopes and exposed banks resulting from construction activities by lessee shall be seeded, fertilized and mulched by lessee as directed by the District Engineer, Geological Survey.

6. Road location and design shall be such that excavation will not remove support from the base of over-steeped slopes or remove the toe of previous slides.

7. Cut and fill slopes designed to exceed the normal angle of repose shall include slope stabilizing measures such as riprap, rock buttresses, bin or retaining walls, piling and horizontal drains.

8. The sidecast of excavated material shall be prohibited on critical slopes (i.e. slopes over 60 percent) and endhaul of such material shall be required.

9. Lessee shall incorporate appropriate measures in its design of stream crossings to limit the need for stream channel relocations and to assure that increases in water velocity will be minimal.

10. Lessee shall refrain from diverting water from streams when such diversion will reduce stream flow below that minimum recommended by the Oregon Department of Fish and Wildlife in its 1972 publication titled "Fish and Wildlife Resources of the Mid-Coast Basin and Their Water Use Requirements."

11. In order to (minimize watershed damage)(protect important wildlife habitat) exploration, drilling and other development activity will be allowed only during the period from to This limitation does not apply to maintenance and operations of producing wells. Exceptions to this limitation in any year may be specifically authorized in writing by the District Engineer, Geological Survey, with the concurrence of the Authorized Officer, Bureau of Land Management.

12. Lessee shall not sever or damage trees identified as nesting sites of the Northern Spotted Owl without specific authority by the District Engineer, Geological Survey, with the concurrence of the Authorized Officer, Bureau of Land Management.

13. In order to minimize disturbance of elk, Lessee shall control vehicular access over road as constructed by Lessee. Only vehicles of Lessee and others authorized by the District Engineer, Geological Survey, shall be provided access. Following Lessee's need for the use of such road, Lessee shall reclaim the right-of-way and block vehicular access except as it may be specifically directed otherwise by the District Engineer, Geological Survey.

14. Lessee shall reclaim sites for drill pads, tank batteries and associated facilities when such sites are no longer needed by Lessee. Such reclaimation shall include during the clearing and preparation of a site the stockpiling of top soil. Such stockpiles shall be contoured and seeded in a manner which will minimize erosion. In additon the site shall be revegetated with native species common to the site prior to development.

15. Lessee shall, in the location and design of roads, trails, pipelines and powerlines requiring rights-of-way greater than 10 feet in width, make use of topographic and vegetative features to minimize the discordant effect of continuous linear clearings.

16. Lessee shall design clearings for drill pads, tanks, batteries and other storage facilities to include a vegetative buffer when such clearings would be visible from (road)(recreation site).

17. Lessee shall paint, with nonreflective paints that blend with the landscape, all pumps, tanks, pipelines and other production related facilities that would be visible from (road)(recreation site).

18. Lessee shall dispose of drilling mud only on sites approved in writing by the District Engineer, Geolgical Survey, with the concurrence of the Authorized Officer, Bureau of Land Management.

19. Lessee shall install suitable mufflers and/or sound dampening housings over pumps and motors when such equipment is creating, as determined by the Authorized Officer, Bureau of Land Mamagement, noise disturbance in nearby residences or recreation sites.

# STATEWIDE OVERVIEW OF POSSIBLE DEVELOPMENT ON FEDERAL OIL AND GAS LEASES IN OREGON

## Introduction

This appendix is an overview of the development which could occur on Federal oil and gas leases in Oregon. The number and location of leases and pending applications in the State are described; and the possible levels of ensuing oil and gas exploration and production activities are considered.

The anticipated environmental effects of exploration and production activities are analyzed in the main body of environmental analysis records prepared for individual blocks of lease applications.

If commercial quantities of oil or gas are found in the State, transportation facilities would be required; and discoveries of oil could lead to the construction or enlargement of refineries. Analysis of the environmental effects of transportation and refining facilities is beyond the scope of the environmental analyses of the lease applications. However, the potential for, and possible magnitude of, pipeline and refinery construction are examined in this appendix. The principal environmental permit and certification processes required of proposed pipeline and refinery projects in Oregon are also described.

As of February 9, 1976, 212 applications for Federal oil and gas leases were on file in Oregon. The applications covered 387,636 acres. In addition, 193,467 acres were already under lease. The total area included in both existing leases and pending applications was 581,103 acres. Areas containing Federal leases and pending lease applications in Oregon are shown in Figure 1.

## Exploratory Drilling

If pending lease applications were approved, at least four or five exploratory wells probably would be drilled on Federal or intermingled private or State land during the next several years. If early tests were favorable, 20 or more wildcat wells might be drilled on lease blocks containing Federal lands.

Many Federal oil and gas leases expire without being explored for oil and gas. This is particularly true outside areas classified by the U.S. Geological Survey as known geologic structures. Since there are no known geologic structures in Oregon, exploratory oil and gas wells probably would be drilled on a relatively small percentage of the leases during the next several years. If oil or gas were discovered, additional exploratory wells would be drilled.

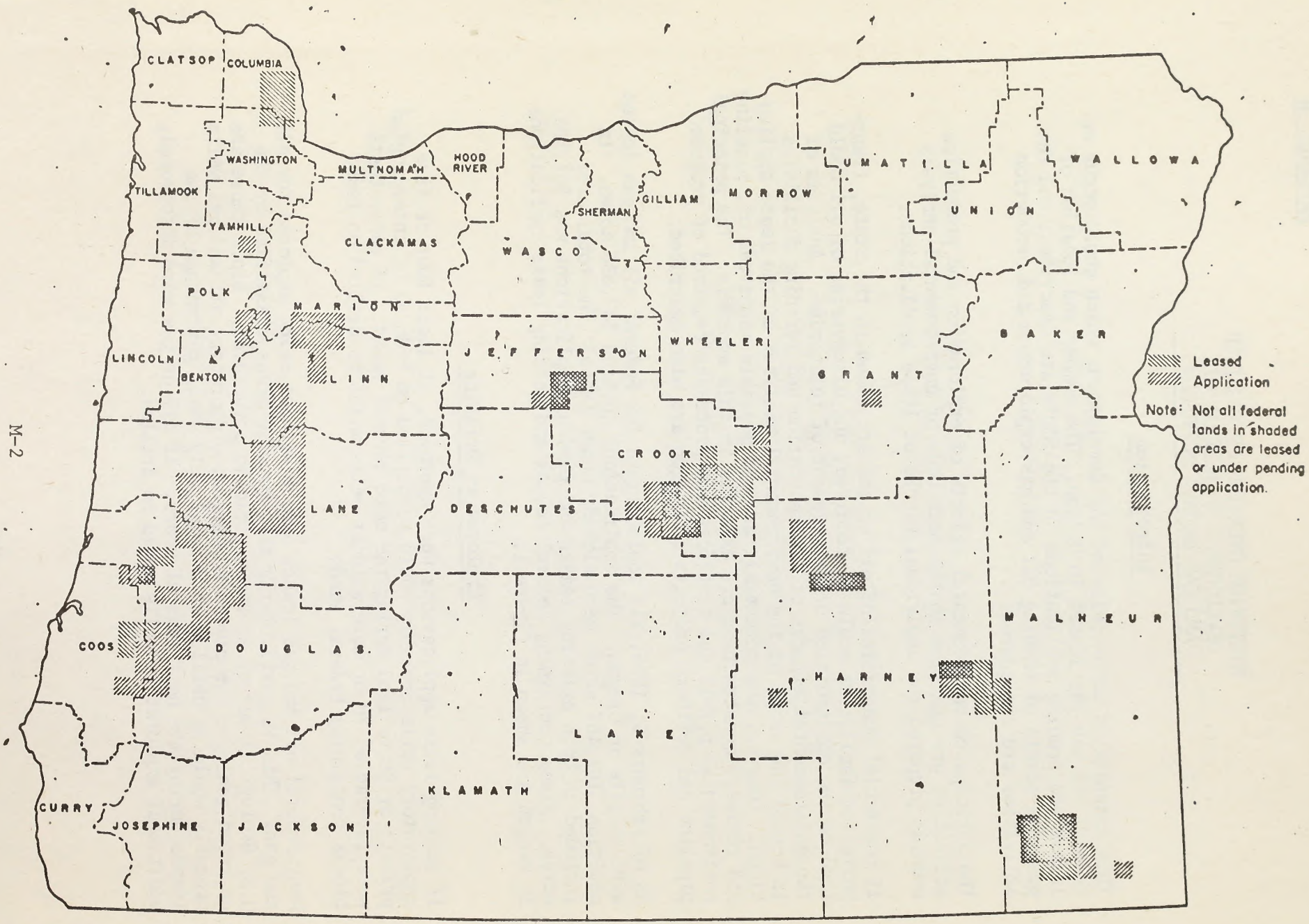



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**FIGURE 1** Areas containing Federal Oil and Gas Leases and Pending Application for Federal Oil and Gas Leases in Oregon, as of February 9, 1976.

The petroleum industry's interest in exploration for oil and gas in Oregon has fluctuated over the years, but it now appears to be increasing. One indication of industry interest in the State is the acreage of Federal oil and gas leases. The total area included in Federal leases in Oregon dropped from a peak of 1,079,740 acres in 1956 to 22,892 acres in 1967. Since 1967, the acreage leased or under application has risen steadily; in early 1976, it stood at 581,103 acres. Oil companies also were reported to be leasing substantial areas of private land in 1975 and early 1976, particularly in the Willamette Valley.

Exploration activities increased in the State in 1975, and it appears that the momentum will extend at least through the next two to three years. Mobil Oil, the major applicant for Federal leases in western Oregon, conducted geophysical and geochemical sampling surveys in the State. Reichold Energy Corporation and Northwest Natural Gas Company drilled four dry holes in western Oregon in 1975 in search of natural gas.

The number and location of lease and lease application blocks provide a general indication of the number and location of exploratory wells which might be drilled during the next several years. Identification of lease blocks in some areas is complicated by the intermingling of leaseholds and lease applications of two or more companies. However, there appear to be about 15 lease or lease application blocks on Federal lands in the State at the present time.

If the first well drilled in a lease block is unsuccessful, it might be the only well drilled in the block during the current cycle of exploratory activity. Many years may pass before the current or a succeeding lessee concludes that another well is warranted. Wells might not be drilled in some blocks if exploration of nearby blocks is unsuccessful. Other blocks might remain unexplored because of the inability of the lessee to secure financing for a drilling operation. In a large block held by a large company, two or more dry holes might be drilled before drilling operations are stopped.

Almost all of the pending lease applications for Federal lands in western Oregon were filed by Mobil Oil; and if a significant portion of the applications is approved, it is likely that more than one exploratory well will be drilled in the company's large lease block. A petroleum engineer for the Oregon Department of Geology and Mineral Industries believes that the company is planning to drill several deep test holes in the next two to three years. (1)

Approximately one acre is required for the drill pad for an exploratory well. Somewhat more land would be needed on sloping land. On a well-per-well basis, more land might be disturbed in the construction of drill pads in western than in eastern Oregon. Because of the road system already developed to harvest timber and the cost of road construction in steep terrain, most wildcat wells in western Oregon probably would be drilled in locations which minimize the need for temporary access roads. In eastern Oregon, wildcat wells would be more likely to require the construction of access roads.

## Oil and Gas Production

Recent experience of the oil and gas industry in the United States may provide a general indication of the possible outcome of oil and gas exploration in Oregon. As indicated in Table 1, the chances of discovering a significant recoverable reserve of oil or gas in the nation in 1974 were approximately 1 in every 59 new-field wildcat wells drilled. When a significant discovery was made in 1974, the odds were greater than 9 to 1 that the area of the field would be less than 2 square miles.

TABLE 1

NEW-FIELD WILDCAT WELLS DRILLED IN U.S. IN 1974:
NUMBER AND PERCENT OF DRY HOLES
AND PRODUCERS BY CLASS OF OIL AND GAS FIELD

| Class of Field 3/ | Total Recoverable 3/ Reserves by Field Class | | Area of Oil Fields 1/ | | Number and Percent of 2/ New-Field Wildcats Drilled in 1974, by Field Class | |
|---|---|---|---|---|---|---|
| | Oil (Mill.Brls.) | Gas (Bill.Cu.Ft.) | Denver-Julesburg Basin. Co. (Sq. Mi.) | California (Sq. Mi.) | Number | Percent |
| I. Producers | | | | | 805 | 14.24 |
| A. Significant | | | | | (96) | (1.70) |
| A | +50 | +300 | -- | -- | 0 | 0 |
| B | 25-50 | 150-300 | 9.7 | 1.7 | 1 | 0.02 |
| C | 10-25 | 60-150 | 5.2 | 1.1 | 7 | 0.12 |
| D | 1-10 | 6-60 | 1.4 | 0.4 | 88 | 1.56 |
| B. Not Significant | | | | | | |
| E | Less than 1 | Less than 6 | 0.6 | 0.2 | 707 | 12.51 |
| F | Abandoned | | | | 2 | 0.3 |
| II. Dry Holes | | | | | 4847 | 85.76 |
| Total New-Field Wildcats Drilled in U.S. in 1974 | | | | | 5652 | 100.00 |

1/ H. W. Menard and G. Sharmen. 1975. "Scientific Uses of Random Drilling Models." Science. Vol. 190, No. 4212.

2/ F. J. Wagner, 1975. "North American Drilling Activity in 1974." Bulletin of the American Association of Petroleum Geologists. Vol. 58, 1273.

3/ Field classifications and "significance" criteria established by American Association of Petroleum Geologists.

All of the 189 oil and gas wells drilled in Oregon since 1902 have been dry holes. In the opinion of the staff of the Oregon Department of Geology and Mineral Industries, however, "There is still potential for finding deposits of oil and gas in Oregon in spite of many past drilling failures . . . . Results of deep drilling have been generally discouraging, but they have shown that there is a thick section of marine sedimentary rocks and that at many locations porous and permeable sands exist within the stratigraphic section." (2) Past drilling in the State has produced numerous shows of oil and gas, but none has been in commercial quantities.

One indication of the chances of discovering commercial quantities of oil and gas in Oregon may be the discovery rate for all new-field wildcat wells in the country. As indicated in Table 1, of the 5652 new-field wildcat wells drilled in the United States in 1974, 805--or one in seven--were finished as producers. However, only 96--or one in 59--resulted in the discovery of fields with significant recoverable reserves.(3) The American Association of Petroleum Geologists considers significant reserves to be those over one million barrels, the amount required to meet the country's petroleum demand for one and one-half hours. The percentage of significant oil or gas finds in total new-field wildcat wells drilled in the United States declined from over three percent in the late 1940's to 1.7 percent in 1974.(4)

Recent drilling experience also provides an indication of the size of field most likely to be discovered. Over the years, a growing percentage of the significant discoveries has been in smaller fields. In the late 1940's, 20 to 25 percent of the significant oil and gas discoveries were in Class "D" fields, the smallest fields in the American Association of Petroleum Geologists' rankings.(5) As indicated in Table 1, 88 of the 96 significant new-field discoveries in 1974, or 92 percent, were in Class "D" fields. From 1968 to 1974, 84 percent of the signficant discoveries were in Class "D" fields.

Table 1 also relates classes of oil and gas fields, as determined by total recoverable reserves, to the area of oil fields in Colorado and California. Class "D" fields average approximately one-half square mile in California and one and one-half square miles in the Denver-Julesburg Basin in Colorado. The average sizes of the fields in each class in the Denver-Julesburg Basin approximate those for the nation as a whole.(6)

It appears, therefore, that if oil or gas is found in Oregon, the chances are better than even that the field will be less than two square miles in size.

The American Association of Petroleum Geologists refers to Class "A" oil and gas fields as "giants." From 1968 to 1974, only 3.1 percent of the significant discoveries in the United States was in giant fields. No giant fields were discovered in the country in 1973 and 1974 (1975 data are not available).(7) Although the chances of a giant field being discovered in Oregon are probably slight, the possibility remains. Examples of large

oil fields in California include the 46-square mile Midway Sunset and 60-square mile Elk Hills fields. The Rio Vista and Sutter Buttes fields are large gas fields in California; both are approximately one square township, or 36 square miles, in area.(8)

The amount of land used in a field for roads, well sites, and other oil and gas field facilities depends largely upon the well spacing pattern. Gas wells tend to be more widely spaced than oil wells. Typical spacing patterns in recently developed fields in California are 10 acres per well in oil fields and 160 acres per well in gas fields.(9) In the Rocky Mountain area, spacing patterns range from 40 to 160 acres per well in most oil fields developed in recent years and from 160 to 640 acres per well in gas fields.(10)

The administrative rules of the Oregon Department of Geology and Mineral Industries require a minimum spacing pattern of 40 acres per well unless a different spacing pattern is approved by the department's governing board.

With a 40-acre-per-well spacing pattern, approximately 12.8 acres per square mile may be used for well sites, roads, and other facilities; with a 320-acre-per-well spacing pattern, about 6.4 acres per square mile may be used.

If a small, two-square mile field is discovered in Oregon, the amount of land used in the field may range from approximately 13 to more than 25 acres. If a large, 50-square mile field is discovered, more than 640 acres may be used for roads, well sites, and other facilities.

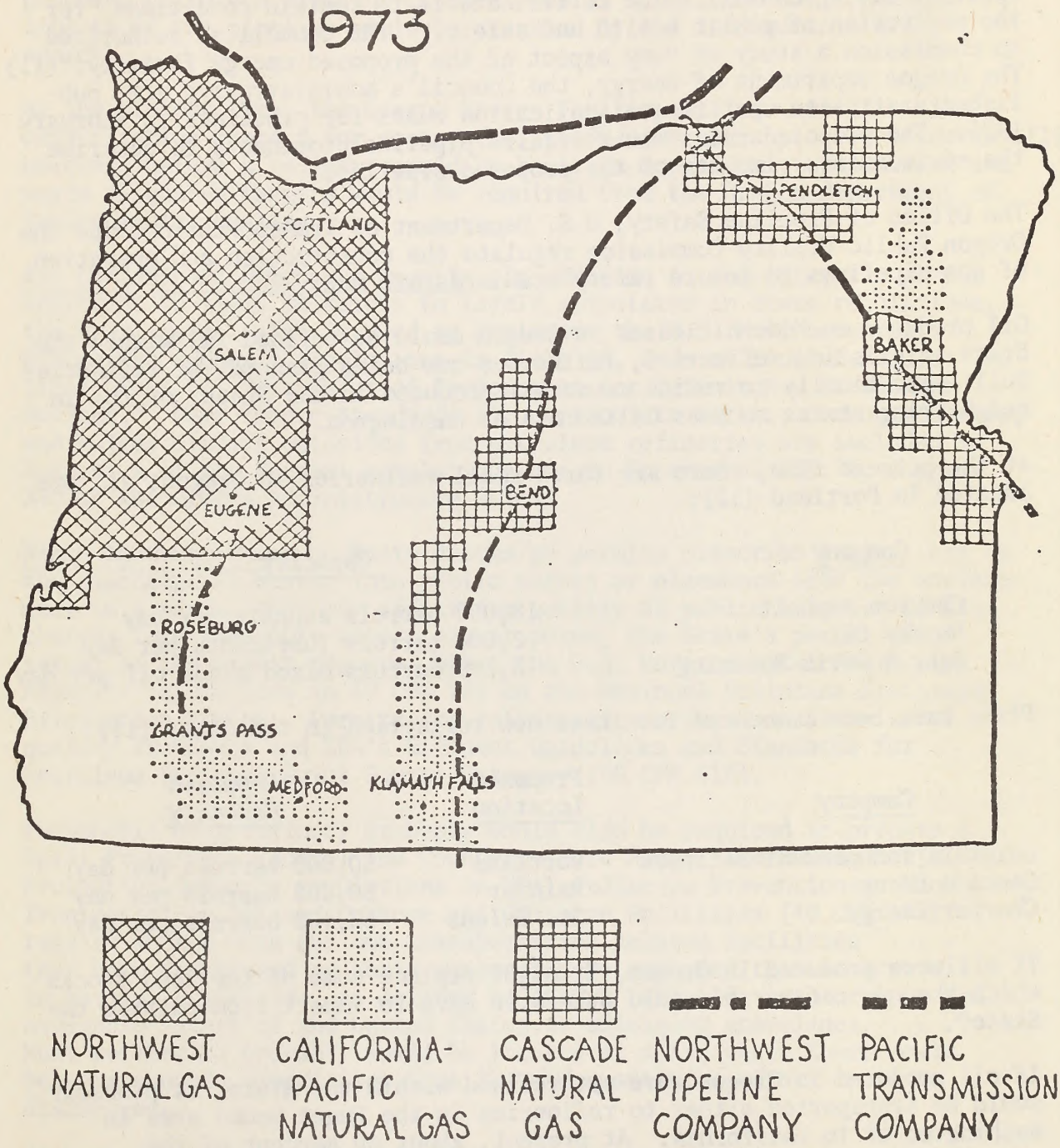
## Transportation and Refining Facilities

If commercial quantities of natural gas were discovered in Oregon, it probably would be sold to natural gas utilities with marketing areas or pipelines in the vicinity of the gas fields. The boundaries of Oregon's natural gas utility districts and major pipeline routes are shown in Figure 2. (The West Coast leg of the proposed Alaska Natural Gas Transportation System natural gas pipeline would parallel all but 21.4 miles of the existing Pacific Gas Transmission Company route shown on the map). Except for those in southeastern Oregon, the lease and lease application blocks are located within a relatively short distance of major existing natural gas pipelines.

If the route of a proposed gas pipeline crossed Federal lands, the land-administering agency would prepare an environmental assessment or analysis record before issuing a right-of-way. (The environmental impacts of flowlines--as distinct from pipelines--constructed on the leasehold to carry gas from the wellhead to a central collection point would be analyzed by the U.S. Geological Survey and the land-administering agency after the lessee submitted a proposed surface use plan for the leasehold.) If anticipated environmental impacts of the proposed pipeline or public interest were determined to be significant, an environmental impact statement would be prepared.

FIGURE 2

# OREGON NATURAL GAS UTILITY DISTRICTS & PIPELINES 1973




SOURCE: Oregon Office of Energy Research and Planning, Transition: A Report to the Oregon Energy Council. January 1, 1975.

In 1975, the Oregon Legislature passed legislation requiring proponents of natural gas pipelines 16 inches or greater in diameter and 5 miles or longer in length to obtain a site certificate from the Oregon Energy Facility Siting Council. The certificate is to contain conditions "for the protection of public health and safety." The council is authorized to commission a study of "any aspect of the proposed energy facility."(11) The Oregon Department of Energy, the Council's administrative arm, published draft site certificate application rules for pipelines in February 1976. The proposed rules would require pipeline proponents to describe the environmental impacts of the proposed pipeline.

The Office of Pipeline Safety, U.S. Department of Transportation, and the Oregon Public Utility Commission regulate the construction and operation of gas pipelines to insure safety standards are met.

Oil produced on Federal leases in Oregon could be refined (a) within the State at existing refineries, refineries now being planned, or refineries built specifically to refine crude oil produced in the State; or (b) in neighboring states such as California or Washington.

At the present time, there are three small refineries in Oregon; all are located in Portland (12):

| Company | Capacity |
|---|---|
| Chevron Asphalt | 18,000 barrels asphalt per day |
| Nu-Way Oil | 2,000 barrels lubricants per day |
| Ager & Davis Refining | 3,500 barrels mixed grade oil per day |

Plans have been ammounced for three new refineries in the State (13):

| Company | Proposed Location | Proposed Capacity |
|---|---|---|
| Columbia Independent Refiners | Portland | 50,000 barrels per day |
| Cascade Energy | Rainier | 30,000 barrels per day |
| Charter Energy | St. Helens | 52,400 barrels per day |

If oil were produced in Oregon, it might replace some of the feed stocks which the new refineries would otherwise have to import from outside the State.

If oil produced in Oregon were not refined within the State, it probably would be transported either to refineries in the Puget Sound area in Washington or to California. At present, about 60 percent of the petroleum products consumed in Oregon are refined in the Puget Sound area.(14)

Unlike natural gas, many miles of new pipeline might be constructed to transport oil produced in the State. There are two petroleum product pipelines but no crude oil pipelines in the State. Other transportation modes might also be used.

The site certification process cited previously for natural gas pipelines in Oregon also applies to crude oil and petroleum product pipelines six inches or greater in diameter and five miles or longer in length. If a proposed petroleum pipeline crossed Federal lands, the environmental impacts of the pipeline would be assessed by the land-administering agency.

At the present time, the Oregon Energy Facility Siting Council's site certification process for energy facilities does not apply to refineries.(15) However, before a refinery could be built in Oregon, air contaminant and waste discharge permits would be required from the Oregon Department of Environmental Quality.

Air Contaminant Discharge Permit: In addition to requiring the permit applicant to limit emissions to levels stipulated in State regulations, the State permit also is used to implement the U.S. Environmental Protection Agency's regulations in Title 40, Code of Federal Regulations, Part 60, "Standards of Performance for Certain New Stationery Sources." Performance standards for particulate matter, carbon monoxide, and sulfur dioxide emissions from petroleum refineries are included in Subpart A of the Federal regulations and in Section 25-000.70, Chapter 340 of the Oregon Administrative Rules.

Waste Discharge Permit: Waste discharge permits prescribe limitations on the discharge of wastes into public waters or elsewhere into the environment in a manner that may affect the quality of public waters. If discharges into navigable waters are proposed, the State's permit also serves as the permit required under the U.S. Environmental Protection Agency's regulations in 40 CFR 125 on the National Pollutant Discharge Elimination System. Permits for refineries are based on State water quality standards and EPA's Effluent Guidelines and Standards for Petroleum Refining Point Source Category (40 CFR 419).

Proponents of a refinery probably would also be required to prepare a Spill Prevention Control and Countermeasure Plan. The Environmental Protection Agency's regulations on "Oil Pollution Prevention in Non-Transportation Related Onshore and Offshore Facilities (40 CFR 112) require such a plan for non-transportation related facilities ". . . that have discharged or could reasonably be expected to discharge oil in harmful quantities, as defined in 40 CFR Part 110, into or upon the navigable waters of the United States or adjoining shorelines. . . ." Most refineries probably would be located at sites where there would be a reasonable expectation that harmful quantities of oil could be discharged.

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4. Ibid.

5. Ibid.

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